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SWATERRESOURCES ABSTRACTS



VOLUME 6, NUMBER 5 MARCH 1, 1973



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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior



VOLUME 6, NUMBER 5 MARCH 1, 1973

W73-02601 - W73-03250

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCU-MENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established disciplineoriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Rioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

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Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORDi

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration: Water Quality Control:

06 WATER RESOURCES PLANNING Includes the following Groups: Techniques of Planning; Evaluation Process: Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS AND FACILITIES Includes the following Groups: Education-Extramural; Education-In-House; Research Facilities; Grants, Contracts, and, Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION Includes the following Groups: Acquisition and Processing; Reference and Retrieval: Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

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SUBJECT INDEX

AUTHOR INDEX STORY OF POPULATION WAS TO STORY OF THE STOR

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

THE STRUCTURE OF TURBULENT FLOWS ADJACENT TO WALLS, For primary bibliographic entry see Field 08B. W73-03060

ISOPIESTIC DETERMINATION OF SOLUBILL TIES IN MIXED SALT SOLUTIONS, TWO SALT

SYSTEMS,
Department of Energy, Mines and Resources,
Burlington (Ontario). Canada Center for Inland For primary bibliographic entry see Field 02K.

02. WATER CYCLE

2A. General

SOME FRATURES OF TIEN SHAN GLACIERS (NEKOTORYYE ZAKONOMERNOSTI OLEDENENIYA TYAN'-SHANYA). Akademiya Nauk Kirgizskoi SSR, Fru Tyanshanskaya Vysokogornaya Fiz Geograficheskaya Stantsiya. For primary bibliographic entry see Field 02C. Fiziko-

SOME EXTENSIONS OF LINEAR SYSTEMS ANALYSIS IN HYDROLOGY, Purdue Univ., Lafayette, Ind. Dept. of Hydraulic

Engineering. J. W. Delleur, and A. R. Rao.

Paper presented at 2nd International Symposium in Hydrology, September 11-13, 1972, Fort Col-lins, Colo: 1972. 11 p, 31 ref. OWRR A-001-IND (6) A-020-IND (2) B-002-IND (4) B-008-IND (8) B-

Descriptors: *Hydrologic systems, *Model studies, *Streamflow forecasting, *Rainfall-runoff relationships, *Stochastic processes, Reviews, relationships, 'Stochastic processes, Reviews, Evaluation, Correlation analysis, Mathematical models, Equations, Hydrology, Storms. Identifiers: *Deterministic systems.

The hypotheses made in the formulation of deterministic and stochastic linear hydrologic systems are reviewed and the limitations of their application are discussed. The increasing number of models requires that they be compared and that their performance be evaluated. The effect of the variation of model parameters on the response of the models needs further investigation. Sensitivity analysis can also be used as a tool for estimation of system parameters. The limitations of linear systems lead to the consideration of quasi-linear models which behave linearly within a storm event but nonlinearly from storm to storm. The separation of rainfall excess based on the Horton type infiltration equation should be replaced by a more realistic concept such as the dynamic contributing area which leads to a semi-distributed model formulation. Making use of the analogy between deterministic and stochastic systems, the application of autoregressive processes is discussed for the simulation of yearly and monthly flows. The need for parameter economy leads to the use of in-tegrated autoregressive-moving average processes. (Woodard-USGS)

TRITIUM IN INVESTIGATION OF SURFACE HYDROLOGY, EXPERIMENTAL DETERMINA-TION OF COEFFICIENT OF RUNOFF,

Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research. For primary bibliographic entry see Field 05B. W73-02713

APPLICATION OF A DIGITAL HYDROLOGIC SIMULATION MODEL TO AN URBANIZED WATERSHED.

Clemson Univ., S.C. Water Resources Research Inst

J. R. Hendricks, Jr. MS Thesis, December, 1971. 81 p, 15 fig, 14 tab, 33

Descriptors: "River basin development, "Watersheds (Basins), "Urbanization, "Effects, "Precipitation, "Hydrologic aspects, "Simulation analysis, "Digital computers, "South Carolina, Optimization, Mathematical models, Systems analysis, Climate.

Identifiers: "Reedy River basin, "Stanford Watershed Model, "Diversions, "OPSET.

Digital simulation was applied to the Reedy River basin near Greenville, South Carolina. The objeconsin near Orienvine, South Caronna. The objective was to determine certain hydrologic characteristics of the basin using available data and to investigate changes brought about in these characvesugate changes orought about in these charac-teristics by the process of urbanization. A self-calibrating version of the Stanford Watershed Model named OPSET was applied to the Reedy River data. To investigate changes in the hydrolog-ic characteristics, parameters were estimated for a rural watershed comparable to the Reedy River basin in size and configuration. Also, parameters were estimated for the Reedy River basin without were estimated for the Reedy River basin without subtracting the estimated diversions from the recorded flows. These two applications were used to investigate by statistical methods, the effects of precipitation and diversions on the OPSET-estimated parameters. After the effects of precipation and diversions were investigated, the changes upon the hydrologic characteristics brought about by urbanization were studied. Hydrologic characteristics by urbanization were studied. Hydrologic characby urbanization were studied. Hydrologic charac-teristics of the Reedy basin were obtained as a result of this study. These can be used in the 1970 Kentucky version of the Stanford Watershed Model to simulate flows. The study indicated that OPSET was not sensitive enough in its present stage of development to detect the changes brought about by urbanization of the basin. Bell-W73-02946

EXPERIMENTAL INVESTIGATION OF CON-VERGING OVERLAND FLOW,
Agricultural Research Service, Fort Collins, Colo.
For primary bibliographic entry see Field 02E. W73-03018

GLOBAL HYDROLOGY.

G. P. Kalinin. Available from NTIS, Springfield, Va 22151 -TT70-50054 Price \$6.00 paper copy. Israel Program for Scientific Translations, Jerusalem, 1971. 310 p. (TT70-50054. Originally published by Gidrometeorologicheskoe Izdatel'stvo, Leningrad, 1968).

Descriptors: *Hydrologic cycle, *Hydrologic budget, *Water balance, *Water resources, *Water utilization, Water levels, Meteorology, water unization, water levels, Meteorology, Climatology, Atmosphere, Circulation, Oceans, Rivers, Lakes, Surface-groundwater relationships, Rainfall-runoff relationships, Variability, Forecasting, Mathematical studies, Computers, United States.

Identifiers: *USSR, *Global hydrology, Global hydrologic cycle, Global water balance, Global water circulation, Global water budget, International programs, International cooperation.

Water in the global context and its role in the for-mation of the earth's surface are discussed. Remation of the earth's surface are discussed. Regional and general laws governing the formation of river regimes are investigated together with variability of global runoff and fluctuations in lake levels. A study of the possibilities for improving probability methods of runoff computations is based on extensive data and application of spacetime analysis to hydrologic processes. Global characteristics of components of the hydrologic cycle are examined to provide a framework for discussion of the future of water resources in the Soviet Union and the United States and of the progress of international research and training programs in hydrology. (Josefson-USGS) grams in hydrology. (Josefson-USGS) W73-03057

WATER FOR TEXAS. Texas A and M Univ., College Station. Water Resources Inst. For primary bibliographic entry see Field 05B. W73-03066

PATTERNS OF DRAINAGE AREAS WITH RAN-

DOM TOPOLOGY, California Univ., Irvine. Dept. of Geography. For primary bibliographic entry see Field 04A. W73-03075

TWO MODELS FOR HORTON'S LAW OF STREAM NUMBERS, California Univ., Irvine. Dept. of Geography. For primary bibliographic entry see Field 04A. W73-03079

SELF-VERIFYING HYBRID COMPUTER MODEL OF RIVER-BASIN HYDROLOGY, Utah Water Research Lab., Logan. R. W. Hill, A. L. Huber, E. K. Israelsen, and J. P.

Water Resources Bulletin, Vol 8, No 5, p 909-921, October 1972. 6 fig, 3 tab, 3 ref. OWRR B-028-UTAH (4).

Descriptors: "Simulation analysis, "Hybrid computers, "Mathematical models, "Water balance, Raifall-runoff relationships, Runoff forecasting, Water management (Applied), Hydrologic cyc, Computer programs, Hydrologic budget, Hydrograph analysis, "Wyoming.
Identifiers: "Bear River basin.

The downstream consequences resulting from changes at specific locations within a hydrologic changes at specific locations within a hydrologic system were studied by hybrid computer simulation of the hydrologic system. Modeling concepts are based upon the development of basic relationships which describe the various hydrologic processes. Within a system these relationships are linked by the continuity-of-mass principle. Spatial procedures in achieved the considerate the modeled resolution is achieved by considering the modeled areas as a series of subbasins. The time increment adopted for the model is one month, so that time varying quantities are expressed in terms of mean monthly values. The model is general in nature and is applied through a programmed verification procedure whereby model coefficients are evaluated for the particular system. In this study the model was applied to the Bear River basin of mouet was applied to the Bear River basin of western Wyoming, southern Idaho, and northern Utah. Comparisons between observed and computed outflow hydrographs show good agreement. (Knapp-USGS)
W73-03183

STOCHASTIC ANALYSIS OF HYDROLOGIC

SYSTEMS, Illinois Univ., Urbana. Hydrosystems Lab.

Ven Te Chow.

In: Proceedings of 14th Congress of International
Association for Hydraulic Research, Hydraulic
Research and its Impact on the Environment, Vol

Group 2A-General

5, p 265-271, 29 August-3 September 1970. 7 p, 7

Descriptors: *Stochastic processes, *Systems analysis, *Hydrologic aspects, *Hydrologic equa-tion, Drainage systems, Basins, Floodwater, Precipitable water, Evapotranspiration, Storage, Time series analysis

Based on the concept of stochastic systems in Based on the concept of stochastic systems in analysis of complex hydrologic phenomena, a general stochastic hydrologic equation was developed and proposed for stochastic analysis of hydrologic systems. To illustrate the application of this approach, two stochastic hydrologic system models for drainage basins were described, namely, a basin yield model (upper Sangamon River Basin) and an annual flood model (French Broad Pariser Basin) and the basin yield model the Basin) and an annual mood model (French Boat River Basin). In the basin yield model, the stochastic processes of precipitation, basin storage and evapotranspiration were considered as a three-dimensional vector or a family of multiple independent time-series. Each stochastic process was assumed to consist of a deterministi ponent and a random component uncorrelated to the deterministic component and other stochastic processes. The annual flood model was the runoff of a flood produced by an annual storm which produced the maximum peak discharge of flood flow in a water year. One drawback of this model was that the computation required a computer of very large capacity in order to compute the matrices of very large size. (Veverka-Cornell) W73-03235

2B. Precipitation

ENERGY INPUT-OUTPUT CLIMATES OF THE WORLD: A PRELIMINARY ATTEMPT, California Univ., Los Angeles. Dept. of Geog-

raphy.
W. H. Terjung, and S. S-F. Louie.
Archiv fur Meteorologie, Geophysik, und Bioklimatologie, Ser B, Vol 20, p 129-166, 1972. 17 fig, 2 tab, 21 ref.

Descriptors: *Climatology, *Model studies, *Cli-Descriptors: "Climatology, "Model studies, "Climatic data, "Input-output analysis, "Forecasting, Data processing, Classification, Energy transfer, Thermodynamic behavoir, Energy budget, Precipitation (Atmospheric), Solar radiation, Albedo, Snowmelt, Latent heat, Temperature. Identifiers: "Global climate classification.

A genetic climatic classification is presented A genetic climatic classification is presented which uses the fluxes of energy and moisture at the interface as its basis. Long and short wave inputs are abstracted into net radiation, whereas latent heat flux, vertical sensible heat flux and horizontal sensible heat flux (at interface level) are used as output components in this global classification. Six climatic groups and sixty-two climates result. For purposes of demonstration of the system, Budyko's model was used to derive the system, Budya's inductives was used to define the necessary data. The main global features portrayed by the scheme are consistent and show reasonable trends. (Woodard-USGS) reasonable W73-02647

PROJECT FOG DROPS. PART 1: INVESTIGA-TIONS OF WARM FOG PROPERTIES, Cornell Acronautical Lab., Inc., Buffalo, N.Y. R. Pilie, W. Eadie, E. Mack, C. Rogers, and W.

Kocmond.

Available from NTIS, Springfield, Va 22151NASA CR-2078, Price \$3.00 paper copy: 95 cents
microfiche. National Aeronautics and Space Administration Contract Report NASA CR-2078, August 1972. 137 p, 57 fig, 6 tab, 39 ref. Contract NASW-2126.

Descriptors: *Fog, *Drops (Fluids), *Condensa-tion, *Meteorological data, *Numerical analysis, Model studies, Data collections, Correlation anal-

ysis, "New York, Atmosphere, Heat transfer, Water vapor, Winds, Dew point, Analytical techniques, Temperature, Aircraft. Identifiers: "Fog data.

Extensive measurements were made of micrometeorological and microphysical characteristics of 11 fogs in the Chemung River Valley near Elmira, New York. Temperature was meanear Elmira, New York. Temperature was mea-sured at 5 levels between 0 and 17 m, dew point at 3 levels, and wind speed and direction at 2 levels. New radiative flux and vertical wind velocity were measured at 17 m. Visibility was observed at 3 lo-cations at a height of 4 feet, and dew deposition was measured at the surface. Observations began was measured at the surface. Observations begins in late evening and continued until the time of fog dissipation. After fog formed, drop samples were collected for size distribution analysis and liquid water content was measured at 15-minute intervals or less. The vertical distribution of temperature from 0 to 300 m and cloud nucleus concentrations from 0 to 300 m and cloud nucleus concentrations were measured from an aircraft at 3-hour intervals before fog formation. Temperature measurements and drop sample collections were made in fog at altitudes above 60 m. A numerical model was developed to investigate the life cycle of fogs. The model predicts the temporal evolution of the vertical distributions of temperature, water vapor, and liquid water as determined by radiative and turbulent transfer of heat, and turbulent transfer of moisture. (Woodard-USGS)
W73-02782

CLOUD CHAMBER DESIGN FOR WATER EVAPORATION STUDIES,
New Mexico State Univ., University Park. Dept.

of Physics. C. E. Dodge. M.Sc. Thesis, 1972. 75 p, 18 fig, 18 tab, 17 ref, 2 append. OWRR A-024-NMEX (1).

Descriptors: *Cloud physics, *Instrumentation, *Analytical techniques, Evaporation retardants, Vapor pressure, Equilibrium, Water properties, Evaporation, Calibrations, Electromagnetic waves, Diffusion, Heat, Atmosphere, Supersatu-

Identifiers: *Cloud chamber design, Cloud densi-

A cloud chamber system was designed and constructed to be used for water evaporation studies. The equipment was calibrated using doubly distilled water and the chamber characteristics determined for eighteen expansion ratios. After the construction and calibration were completed provisions were made to study the effects of conaminants and evaporation retardants. (Creel-New Mexico State) W73-02889

AN EXPANSION CLOUD CHAMBER STUDY OF WATER EVAPORATION, New Mexico State Univ., University Park. Dept.

of Physics. S. E. Loftin.

M.Sc. Thesis, 1972. 75 p, 19 fig, 2 tab, 18 ref, 2 append. OWRR A-024-NMEX (2).

Descriptors: *Cloud physics, *Evaporation, *Monomolecular films, *Evaporation retardants, Meteorology, Heat exchangers, Surface tension, Drops (Fluids), Octadecanol.

Drops (Futuss), Octateceanos. Identifiers: "Expansion cloud chamber, "Alcohol monolayers, Cloud density, Atmospheric structure, Cloud formation, Inert atmospheres, Temperature gradient on cloud formation, Dodecanol, Air-liquid interface.

The expansion cloud chamber was applied to the study of evaporation from bulk liquids. After determining the effects of chamber atmospheric structure and temperature gradient on cloud formation, the evaporation characteristics of pure water and the effect of the presence of contami-

nants (surface and dissolved) were investigated. An analytical technique was developed to determine the relative resistance of a liquid surface to evaporation. Since chemical monolayers play an important role in evaporation reduction, an experiment into heat exchange at the air-liquid interface of a monolayer covered surface was conducted. (Creel-New Mexico) W73-02890

SPATIAL VARIATION OF RAINFALL SPEC-

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TRA IN SOUTH AFRICA, University of the Witwatersrand, Johannesburg (South Africa). Dept. of Geography.

P. D. Tyson. Association of American Geographers, Annals, Vol 61, No 4, p 711-720, December 1971. 9 fig, 8

Descriptors: "Precipitation (Atmospheric), "Rainfall, "Climatology, Stations, "Weather data, Hydrologic cycle, "Regional analysis, Meteorology, Hydrology, Climatic data, Data collections, Cycles. entifiers: *South Africa.

The evidence for recent changes in South African climate, particularly rainfall, is not clear. Temporal and spatial oscillations of mean annual rainfall over South Africa were therefore examined. Results from fourier and spectral analysis of rainfall records at 163 stations over the period 1910-1969, and at 39 stations from 1880-1969, show that cyclical fluctuations with periods of about 18-20, 13-15, 10, 4.5, 3.5, 2.8, and 2.3 years account for much of the observed rainfall variance over the country. These fluctuations exhibit distinctive re-gional distributions that appear to have changed little over the last century. (Black-Arizona) W73-03100

HYDROLOGIC CONDITIONS VIEWED BY THE NIMBUS METEOROLOGICAL SATELLITES, Allied Research Associates, Inc., Lanham, Md. For primary bibliographic entry see Field 07B. W73-03135

PERFORMANCE OF AN ATMOSPHERIC WATER RESOURCES RESEARCH PROGRAM IN THE HUNGRY HORSE AREA, MONTANA. For primary bibliographic entry see Field 03B. W73-03143

GROMET II-RAINFALL AUGMENTATION IN THE PHILIPPINE ISLANDS, Naval Weapons Center, China Lake, Calif. For primary bibliographic entry see Field 03B. W73-03149

2C. Snow, Ice, and Frost

SOME FEATURES OF TIEN SHAN GLACIERS (NEKOTORYYE ZAKONOMERNOSTI OLEDENENIYA TYAN'-SHANYA). Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanakaya Vysokogornaya Fiziko-Tyanshanskaya Vysoko Geograficheskaya Stantsiya.

Izdatel'stvo 'Ilim', Frunze, Zabirov, R.D., editor, 1971.155 p.

Descriptors: *Glaciology, *Glaciation, *Glaciers, *Glacial drift, *Ablation, Melt water, Snow, Firn, Ice, Water balance, Heat balance, Radiation, Ru-noff, Streams, Lakes, Topography, Climatology, Meteorology, Precipitation (Atmospheric), Tem-

Identifiers: *USSR, *Tien Shan Mountains, *Glacier mass balance, Glacier runoff, Glacier flow, Glacial erosion, Glacial streams, Glacial lakes, Glacier tongues, Ice sheets. This collection of 14 papers provides information on the morphology, movement, mass balance, and recent variations of glaciers in the Tien Shan mountain system. Among the topics discussed are:

(1) mass budget of the Kara-Batkak Glacier of the mountain system. Among the topics discussed are; (1) mass budget of the Kara-Batkak Glacier of the Terskey Ala-Too range; (2) water balance of the Kara-Batkak Glacier basin; (3) ablation of the Semenov Glacier; (4) rate of movement, ablation, and dynamics of glaciers of the Ak-Shiyrak range; (5) heat balance of the Kara-Batkak Glacier surface during an ablation season; (6) dynamics and structure of the Yuzhanys Inyl'chek Glacier; (7) morphology of Glacial Lake Merzbacher and mechanics of its catastrophic outbursts; (8) climatic features of the alpine zone of east-central Tien Shan during a warm season; (9) secular growth and variations of Tien Shan glaciers; and (10) mechanism of formation of glacier terminal moraines and role of water in glacial erosion. (See W73-02634 thru W73-02642) (Josefson-USGS) W73-02634

MASS BUDGET OF THE KARA-BATKAK GLA-CIER ON THE NORTHERN SLOPE OF THE TERSKEY ALA-TOO BANGE OF THE TERSKEY ALA-TOO RANGE (BYUDZHET LEDNIKOV SEVERNOGO SKLONA KHREBTA TERSKEY ALA-TOO NA PRIMERE LEDNIKA

KARA-BATKAK),
Akademiya Nauk Kirgizskoi SSR, Frunze.
Tyanshanskaya Vysokogornaya FizikoGeograficheskaya Stantsiya.

In: Nekotoryye zakonomernosti oledeneniya Tyan'-Shanya; Izdatel'stvo 'Ilim', Frunze, p 16-29, 1971. I fig, 12 tab, 13 ref.

Descriptors: "Glaciology, "Glaciers, "Mountains, "Ablation, Melting, Runoff, Glacial drift, Snow cover, Snowpacks, Firn, Ice, Precipitation (Atomospheric), Air temperature. Identifiers: "USSR, "Kirgiz SSR, "Tien Shan Mountains, "Glacier mass budget, Glacier accumulation, Glacier wastage, Glacier runoff, Glacier tongues, Valley glaciers, Firn line.

Mass balance terms for the Kara-Batkak Glacier on the northern alope of the Terskey Ala-Too range in the Tien Shan mountain system in the Kirgiz Republic were investigated in 1957-66 for glacier mass budget. A positive budget was observed in 1957-58 and 1964-65 and a negative budget in 1959-22 and a regative budget in 1959-18 and 1964-65 and a negative budget in 1959-18 and 1964-65 an 63 and again in 1966. Despite longer periods of ablation, accumulation exceeded wastage, with the difference being 0.85 million cu m. Retreat of the glacier tongue, averaging 5-6 m a year for 1947-64, is soon expected to stop. (See also W73-02633) (Josefson-USGS) W73-02634

WATER BALANCE OF THE KARA-BATKAK GLACIER BASIN (VODNYY BALANS LED-NIKOVOGO BASSEYNA NA PRIMERE LED-

NIKA KARA-BATKAK), Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanskaya Vysokogornaya Fiziko-Geograficheskaya Stantsiya.

In: Nekotoryye zakonomernosti oledeniya Tyan'-Shanya; Izdatel'stvo 'Ilim', Frunze, p 30-38, 1971. 2 fig, 3 tab, 8 ref.

Descriptors: "Glaciology, "Glaciers, "Water balance, "Runoff, "Meteorology, Precipitation (Atmospheric), Air temperature, Melt water, Melt-ing, Ablation, Snow, Firn, Ice, Glacial drift, Slopes, Streams, Gaging stations, Equations, Identifiers: "USSR, "Kirgiz SSR, "Glacier mass budget, "Glacial streams, "Glacier runoff, Glacier tongues, Firn line, Firn fields, Lateral moraines.

Runoff composed of melt water and precipitation on the surface and surrounding slopes of the Kara-Batkak Glacier in the Kirgiz Republic was in-vestigated in 1956-65 to determine the role of in-dividual components of the water balance of a gla-cier-fed stream. Average glacier runoff during the

period of study was 53% of total annual runoff at the gaging station near the glacier's terminal moraine. In 1956 and 1961, when air temperatures were high, glacier runoff was 64%-70% of annual runoff. In 1957, 1958, and 1964, when air temperatures were low, the predominant runoff was that produced by snowmelt and icemelt and was \$2%-57% of the annual runoff. (See also W73-02633) (Josefson-USGS) W73-02635

ABLATION OF THE SEMENOV GLACIER (TAYANIYE LEDNIKA SEMENOVA), Akademiya Nauk Kirgiziskoi SSR, Frunze. Tyanshanskaya Vyaokogornaya Fiziko-Geograficheskaya Stantsiya. A. N. Dikikh.
In: Nekotoryye zakonomernosti oledeneniya Tyan 'Shanya; Izdatel'stvo 'llim', Frunze, p 39-46, 1971. I fig. 5 tab. 4 ref.

Descriptors: "Glaciology, "Glaciers, "Ablation, "Melting, Melt water, Snowmelt, Snow, Ice, Glacial drift, Precipitation (Atmospheric), Air temperature, Heat balance, Radiation, Convection, Condensation.
Identifiers: "USSR, "Tien Shan Mountains, "Glacier mass budget, "Heat sources, Ablation stakes.

Low air temperatures and frequent snowfalls in summer reduce the ablation season on the Semenov Glacier, which covers an area of 21.5 km in the eastern half of the Soviet Tien Shan Mounin the eastern half of the Soviet Tien Shan Mountain system. From July 10 through August 31, 1962, the period of icemelt was 19 days, that of icemelt and snowmelt—12 days, and that of snow-melt—2d ays. Average daily ablation was 2.5 cm. Depending on glacial drift, total ablation at different points during the 53-day period varied between 72.5 cm and 149.5 cm. At elevations of 3,540 to 3,820 m, ablation was uniform. Ablation at elevation 3.20 m was twice that at elevation 4.200 a passion was uniform. Ablation at elevation 3,820 m was twice that at elevation 4,200 m. Radiation provided an average of 75% of the total heat supply and on two different days (August 9, 16) it contributed 96%. The order of importance of the heat sources during the ablation season was radiation, convection, cond (See also W73-02633) (Josefson-USGS)

RATE OF MOVEMENT, ABLATION, AND DYNAMICS OF SOME GLACIERS OF THE AK-SHIYRAK RANGE (SKOROSTNOY REZHIM, TAYANIYE I DINAMIKA NEKOTORYKH LED-

TAYANIYE I DINAMIKA NERUTUKYKH LED-NIKOV MASSIVA AK-SHIYAK), Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanskaya Vysokogornaya Fiziko-Geograficheskaya Stantsiya. Ye. K. Bakov.

In: Nekotoryye zakonomernosti oledeneniya Tyan'-Shanya; Izdatel'stvo 'Ilim', Frunze, p 47-53, 1971. 6 tab, 8 ref.

Descriptors: *Glaciers, *Mountains, Detemptors: "Velocity, Precipitation (Atmospheric), Air temperature, Surfaces, Ice, Elevation. Identifiers: "USSR, "Tien Shan Mountains, "Giacier mass budget, "Glacier dynamics, Glacier activity, Glacier retreat, Glacier tongues, Valley glaciers, Ice thickness, Velocity distribution.

Morphology and dynamics of the Lysyy, Davydov, Sary-Tor and Bordu-severnyy valley glaciers of the northwest Ak-Shiyrak range in the Tien Shan mountain system were investigated in the summer of 1967 for rate of movement and ablation. The total area of the glaciers is 25.48 sq. km. The rates of ice movement are low and vary between 3.6 m/yr on the Sary-Tor Glacier to 23 m/yr on the Davydov Glacier. Ablation values for the glaciers are lower than those for glaciers of adjoining regions and average 1.83 cm/day. According to radar measurements, the thickness of the Davydov Glacier is 60 m. Orographic location and morphological characteristics of the glaciers favor

the maintenance of a balanced glacier budget. (See also W73-02633) (Josefson-USGS) W73-02637

HEAT BALANCE OF THE KARA-BATKAK GLACIER SURFACE DURING AN ABLATION SEASON (TEPLOVOY BALANS POVERKH-NOSTI LEDNIKA KARA-BATKAK V PERIOD

NOSTI LEDNIKA KARA-BATKAK V PERIOD TAYANIYA), Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanskaya Vysokogornaya Fiziko-Geograficheskaya Stantsiya. A. N. Dikikh. In: Nekotoryye zakonomernosti oledeneniya Tyan-'Shanya; Izdatel'stvo 'llim', Frunze, p 54-60, 1971. 3 tab, 5 ref.

Descriptors: "Glaciology, "Glaciers, "Surfaces, "Heat balance, Heat flow, Heat transfer, Heating, Melting, Ablation, Temperature, Thermocline, Radiation, Convection, Condensation, Precipitation (Atmospheric), Ice, Equations. Identifiers: "USSR, "Kirgiz SSR, "Glacier surfaces, "Heat sources, Heat exchange, Ablation stakes"

Examination of the role of heat-balance components for the Kara-Batkak Glacier in the Kirgiz Republic during the 1961-62 ablation season was based on radiation, temperature, and humidity observation data. The total amount of heat used for melting varied between 192 and 472 cal/sq cm. In meiting varied between 192 and 472 cal/aq cm. In July 1961, radiation provided 74% of the total heat supply. The contribution of convection was 14.1% and that of condensation 11.9%. In August 1961 and July 1962, radiation provided 58.3% of the total heat supply, while the contribution of convection and condensation for this period increased to 22.4% and 19.3%, respectively. (See also W73-02633) (Josefson-USGS) W73-02638

DYNAMICS AND STRUCTURE OF THE YUZH-DYNAMICS AND STRUCTURE OF THE YUZH-NYY INYL'CHEK GLACIER (VOPROSY DINAMIKI I STRUKTURY LEDNIKA YUZH-NYY INYL'CHEK), Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanskaya Vysokogornaya Fiziko-Geograficheskaya Stantsiya.

Geogrammeskaya Stantsiya.
S. E. Ayrapet'yants, and Ye. K. Bakov.
In: Nekotoryye zakonomernosti oledeneniya
Tyan'-Shanya; Izdatel'stvo 'llim', Frunze, p 6174, 1971. 7 fig, 4 tab, 8 ref.

Descriptors: *Glaciology, *Glaciers, *Flow, *Movement, *Velocity, Ablation, Ice, Firn, Glacial drift, Surfaces, Profiles, Radar. identifiers: *USSR, *Tien Shan Mountains, *Glacier dynamics, *Glacier flow, Ice sheets, Ice structure, Ice thickness, Ice movement, Glacier tongues, Glacial lakes.

Dynamics and structure of the Yuzhnyy Inyl'chek Glacier, a large glacier in the Tien Shan mountain system in Central Asia, were investigated in 1967 for glacier flow and ice thickness. Surface movefor glacier flow and ice thickness. Surface move-ment of the central part of the glacier averaged 35-40 cm/day. Ice thicknesses measured by radar varied from 80-100 m at the left edge of an ice sheet profile to 360 m at the right edge. The glacier consists of three ice layers, of which the upper 50-60 m layer is the most active. (See also W73-02633) (Josefson-USGS) W73-02639

MORPHOLOGY OF GLACIAL LAKE MERZ-BACHER AND MECHANICS OF ITS CATASTROPHIC OUTBURST (MOR-CATASTROPHIC OUTBURST (MODERS OF COLOGINAL LEDNIKOVOGO OZERA MERT-SBAKHERA I MEKHANIZM YEGO KATAS-TROFICHESKIKH PRORYVOV), Akademiya Nauk Kirgizskoi SSR, Frunze. Akademiya Nauk Kirgizskoi SSR. Tyanshanskaya Vysokogornaya Geograficheskaya Stantsiya. S. E. Ayrapet'yants, and Ye K. Bakov. Fiziko-

Group 2C-Snow, Ice, and Frost

In: Nekotoryye zakonomernosti oledeneniya Tyan'-Shanya; Izdatel'stvo 'Ilim', Frunze, p 75-84, 1971. 5 fig, 3 tab, 7 ref.

Descriptors: "Glaciology, "Glaciers, "Lakes, "Lake morphology, Lake morphometry, Lake basins, Lake beds, Glacial drift, Flow, Velocity, Discharge (Water), Water levels, Ice, Icebergs, Mountains. "Glacial lakes, "Glacial-lake outbursts, Glacier floods, Glacier flow, Corrie glaciers, Hanging glaciers,

Investigations were conducted in the region of Glacial Lake Merzbacher in the central Tien Shan Glacial Lake Merzoacher in the central lien Shan mountain system between Severnyy and Yuzhnyy Inyl'chek Glaciers to study the mechanics and cause of the sudden outbreak of water from the glacier-dammed lake. Morphology and nourishment of the lake were examined together with its condition before, during, and after an outbreak. A periodicity in lake outbursts was observed, with the outbreaks occurring almost invariably in August or September. (See also W73-02633) (Josef-son-USGS) W73-02640

SECULAR GROWTH OF SOME TIEN SHAN GLACIERS (O POLUVEKOVOM RAZVITII NEKOTORYKH TYAN'-SHAN'SKIKH LED-

Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanskaya Vysokogornaya Fiziko-Geograficheskaya Stantsiya. L. G. Bondarev.

In: Nekotoryye zakonomernosti oledeneniya Tyan'-Shanya; Izdatel'stvo 'Ilim', Frunze, p120-129, 1971. 4 fig, 1 tab, 11 ref.

Descriptors: *Glaciology, *Glaciation, *Glaciers, Glacial drift, Ice, Snow, Mountains, Valleys, Slopes, Avalanches, Precipitation (Atmospheric), Air temperature, Elevation, Aerial photography, Investigations.

Investigations.

Identifiers: *USSR, *Tien Shan Mountains, *Glacier activity, *Glacier advance, *Glacier retreat, Glacier tongues, Corrie glaciers, Hanging glaciers, Lateral moraines, Terminal moraines.

Investigations by Hungarian explorer G. Prinz in Tien Shan in 1906-09 coincided with a period of high precipitation and high glacier activity. At the beginning of the century many Tien Shan glaciers were either in a period of advance or in a static condition, with only little evidence of ice shrinkcondition, with only little evidence of ice shrink-age. Glacier advances were recorded in a number of regions, including the Karakoltor and Sary-Tor valleys of the Terskey Ala-Too range and the Dz-hangart River basin of the Kokshaal-Too range. The period 1906-1962 was a period of glacier reces-sion. Particularly significant was the retreat of the Kuylyu-Karakoltor Glacier, which lost 1,250 m in length in 1906-43, 1,200 m in 1943-56, and 400-450 m in 1956-59. According to date callected by Prior m in 1956-59. According to data collected by Prinz, the period of activity of Tien Shan glaciers began before 1906-07. (See also W73-02633) (Josefson-USGS) W73-02641

MECHANISM OF THE FORMATION OF SOME 'TERMINAL MORAINES' AND ROLE OF WATER IN GLACIAL EROSION (MEKHANIZM OBRAZOVANIYA MEKOTORYKH 'KONECHNYKH MOREN' I ROL' VODNOY EROZII V DINAMIKE LEDNIKA), Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanskaya Vysokogornaya Fiziko-Geografichskaya Stantsiya.

Geograficheskaya Stantsiya.

In: Nekotoryye zakonomernosti oledeneniya Tyan'-Shanya; Izdatel'stvo 'Ilim', Frunze, p 130-136, 1971. 4 fig, 2 ref.

Descriptors: *Glaciology, *Glaciation, *Glaciers, *Glacial drift, *Erosion, Movement, Ice, Melt

water, Streams, Mountains, Aerial photography, On-site data collections. Identifiers: "USSR, "Glacier dynamics, "Glacial erosion, "Glacial streams, "Terminal moraines, Lateral moraines, Medial moraines, Glacier ton-gues, Valley glaciers, Corrie glaciers.

Examination of aerial photographs and field data for 1943-66 reveals that the 6-km long Turgen'-Aksu valley glacier in the eastern half of the Terskey Ala-Too range is in a nearly static condition. Formation of terminal moraines is associated with Formation of terminal moranies is associated with the degradational processes of the glacier. Erosion by melt water plays an important role in the dynamics of the glacier, which is expected soon to lose about 1.20 sq km of buried ice. (See also W73-02633) (Josefson-USGS) W73-02642

REMOTE SENSING OF SEA ICE FROM EARTH

SATELLITES,
National Environmental Satellite Center,
Washington, D.C.
For primary bibliographic entry see Field 07B. W73-02645

GLACIER SURVEYS BY DISTRICT PERSON-NEL OF THE WATER SURVEY OF CANADA: 1.
THE VICTORIA GLACIER,
Department of the Environment, Ottawa (Ontario). Inland Waters Branch.

C. S. L. Ommanney.
Canada Department of the Environment Inland Waters Branch Glacier Inventory Note No 6, April, 1971. 18p, 7 fig, 4 tab, 8 ref.

Descriptors: *Glaciers, *Movement, *Canada *Water balance, Water yield, Surveys, Water resources, Data collections, Hydrologic data, Discharge (Water). Identifiers: *Victoria Glacier (Canada).

Victoria Glacier is located on the eastern side of the Continental Divide, the provincial boundary separating British Columbia and Alberta, in the Plain of the Six Glaciers, some 5 km from Chateau Lake Louise. A continuous ice stream flows northwards from Abbot Pass (2,923 m) for about 2 km before turning sharply to the northeast where it degenerates into an indistinct debris-covered ice tongue after another 2 km. However, the Abbot Pass basin contains less than 20% of the total accumulation area of Victoria Glacier. The remainder, some 1.8 sq km, lies in a broad ice apron that stretches from Popes Peak, past Mount Victoria, towards Abbot Pass and avalanches 300 m or more to form a reconstituted ice mass at the point where the Abbot Pass stream changes direction. It is an the Abbot Pass stream changes direction. It is an interrupted valley glacier. In 1945 a transit point was established near the snout of the glacier. A reference line, bearing S 87 deg E magnetic, 185 feet long (56.4 m), was used as a base. A summary of all the observations made by the Dominion Water and Power Bureau, and some earlier figures, is given. The discharge of Lake Louise Creek was measured from 1948 to 1954 at the time the surrect water carried out (K men. LISGS). the surveys were carried out. (Knapp-USGS) W73-02648

STABILITY OF FLOATING ICE BLOCKS, Iowa Univ., Iowa City. Inst. of Hydraulic

Research.

M.S. Uzuner, and J. F. Kennedy.

Journal of the Hydrualics Division, American
Society of Civil Engineers, Vol 98, No HY12, Paper 9418, p 2117-2133, December 1972. 9 fig, 12

Descriptors: *Ice, *Ice cover, *Ice breakup, *Ice jams, Streams, Floods, Flood control, Flumes, Hydraulic models, Mathematical models, Open channel flow.
Identifiers: *Floating ice.

The critical conditions at which buoyant blocks on a flowing stream are swept under a downstream floating cover were investigated analytically and experimentally. The mathematical model of block stability is based on a one-dimensional hydrodynamic analysis of the flow passing beneath the upstream end of a floating cover, and the force and moment equilibrium of the block. The condition of incipient submergence is reached when the block sinks and rotates until the stagnation water surface elevation equals that of the top upstream edge of the block. Experiments to verify the analysis were conducted in a 1-ft wide laboratory flume using right parallel-piped blocks with three different specific gravities and a range of length-thickness ratios. The moment coefficient which arises in the analysis was evaluated by The critical conditions at which buoyant blocks on iengur-trickness ratios. The moment coefficient which arises in the analysis was evaluated by means of the experimental data, which were found to be in good agreement with the analytical results. (Knapp-USGS) W73-02792

REMOTE SENSING OF SNOW FIELDS FROM

EARTH SATELLITES,
National Environmental Satellite Service,
Washington, D.C.
For primary bibliographic entry see Field 07B. W73-03133

NIMBUS 3 AND 4 OBSERVATIONS OF SNOW COVER AND OTHER HYDROLOGICAL FEA-TURES IN THE WESTERN HIMALAYAS, National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. For primary bibliographic entry see Field 07B. W73-03134

2D. Evaporation and Transpiration

A PHYSIOLOGICAL STUDY ON VARIATIONS A PHYSIOLOGICAL STUDY ON VARIATIONS
OF DRY MATTER PERCENT OF TUBER IN
SWEET POTATOES (IN JAPANESE),
Osaka Univ. (Japan). Dept. of Biology.
For primary bibliographic entry see Field 03F.
W73-02692

THE INFLUENCE OF MIST IRRIGATION ON THE POTATO I. MICRO-ENVIRONMENT AND LEAF WATER RELATIONS,
Minnesota Univ., St. Paul. Dept. of Horticultural

For primary bibliographic entry see Field 03F. W73-02888

CLOUD CHAMBER DESIGN FOR WATER EVAPORATION STUDIES, New Mexico State Univ., University Park. Dept.

of Physics. For primary W73-02889 mary bibliographic entry see Field 02B.

AN EXPANSION CLOUD CHAMBER STUDY OF WATER EVAPORATION,
New Mexico State Univ., University Park. Dept.

of Physics. For primary bibliographic entry see Field 02B. W73-02890

WATER LOSS FROM LEAVES AS AFFECTED BY PREVIOUS EXPOSURE IN AN AT-MOSPHERE SATURATED WITH WATER VAPOR,

J. Pazourek Biol Plant (Praha). Vol 14, No 1, p 89-91. 1972. Il-

ldentifiers: Atmosphere, Betula verrucosa D, Exposure, Hedera helix D, *Leaves, Loss, Medicago sativa D, Saturated, *Transpiration, Vapor.

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Streamflow and Runoff—Group 2E

The transpiration rate of detached leaves of Betula verrucosa, Medicago sativa and Hedera helix, ex-posed to an atmosphere saturated with vapor, in-creased after a certain time. This time as well as the shape of the transpiration curves varied ac-cording to the duration of the exposure of the leaves in the humid atmosphere.—Copyright 1972, Biological Abstracts, Inc. W73-02925

A CONTRIBUTION TO THE STUDY OF TRANSPIRATION IN WOODY SPECIES (IN CZECH.), Skola

Vysoka Skol zechoslovakia). Zemedelska, Brno

ved Cas Uvti Ustav Vedeckotech Inform Les. Vol 15, No 6, p 507-518. 1969. Illus. English summary. Identifiers: Plant growth, *Consumptive use, Ivanov method, Plants, Rates, Species, *Trans-piration.

Transpiration in seedlings of woody species was estimated by the Ivanov method. The transpiration of the experimental seedling was expressed by the rate of transpiration and by the water consumption for transpiration. The rate of transpiration in woody species seedlings is expressed best in mg/g water content of leaf matter/min, or in mg/cm2 water content of sear matter/min. The consumption of water transpired by seedlings is expressed best in mg/min (STM), mg/hr (STH), mg/day (STD), for a period of several days (STP), and for the entire growing season (ST). From the value obtained for the consumption of water transpired by a sinfor the consumption of water transpired by a single seedling the total water consumption of a stand (nursey) involving all its seedlings, from a certain area (ST/sq m, ST/are, ST/ha) can be calculated.—Copyright 1972, Biological Abstracts, Inc. W73-02950

A METHOD FOR THE DETERMINATION OF THE THERMAL PROPERTIES OF SOIL NEAR

THE SURFACE,
Bari Univ. (Italy). Istituto di Geodesia e Geofisica.
For primary bibliographic entry see Field 02G.
W73-03075

USE OF DIGITAL COMPUTERS FOR THE HEAT AND MASS TRANSFER ANALYSES OF CONTROLLED ENVIRONMENT GREEN-HOUSES,

Arizona Univ., Tucson. Environmental Research Lah.

In: First Symposium on the Use of Computers for Engineering Related to Buildings, Proceedings, National Bureau of Standards, Githersburg, Maryland, Nov 30-Dec 2, 1970. p 557-578. 3 tab, 6 fig, 10

Descriptors: *Greenhouses, *Computer programs, *Soil-water-plant relationships, *Structures, Digital computers, Analytical techniques, Environment, Computer programs, Energy budget, Mathematical studies.

Prediction of temperatures and humidities in a Prediction of temperatures and humidities in a controlled-environment greenhouse enables the design engineer to maintain the temperature of air and leaf within the safe and productive margins given by the horticulturalist. Computation methods and details of the computer programing of an extensive study of the heat and mass balances of controlled environment greenhouses are presented. Various programs were written to solve the architect of different phases, as made to are presented. Various programs were written to solve the problem at different phases; namely, the analysis without any moisture effects, studies with transpiration taken into consideration, and, ultimately, the model with evaporation from the soil, transpiration from the plants and condensation over the plastic cover whenever its temperature drops below dew point of the air stream. The computer programs developed may be used in predicting the controlled-environment greenhouse per-formance under continuous operation conditions for any locality, if weather data are supplied. This information also will enable the designer to determine the capacity of the packed bed humidifiers, circulation fans and water requirements of humidifiers for irrigation purposes. (Black-Arizona) W73-03082

EFFECT OF SEVERAL TRANSPIRATION SUP-PRESSANTS ON CARBON DIOXIDE AND WATER VAPOR EXCHANGE OF CITRUS AND GRAPEVINE LEAVES, Hebrew Univ., Jerusalem (Israel). Faculty of

Ben-Ami Braydo

Ben-Ami Bravdo.
Physiol Plant. Vol 26, No 1, p 152-156. 1972. Illus. Identifiers: Analyzers, "Carbon dioxide, "Citrus D leaves, Citrus ainensis D. Cyanates, Ethylene, Grapevine D. Hygrosensors, Leaves, Lithium, Photosynthesis, Respiration, Stomata, "Transpiration suppressants, Vitis vinifera var sultanina D, "Water vapor exchange.

Several transpiration suppressants, (phenyl mer-curic acetate, Tag 16 (polyethylene emulsion), R14-poly (ethylene adipate), 4-4 diphenylmethane diisocyanate), which are known to either close sto-mata or form thin films on leaves, were sprayed on citrus (Citrus sinensis) and grapevine (Vitis vinifera var. sultanina) seedlings. Water vapor and vinitera var. suitanina) seedlings, Water vapor and CO2 exchange of single leaves were measured by means of IR gas analyzer and LiCl hygrosensors. The effects of the chemicals were evaluated by analyzing net photosynthesis, transpiration, mesophyll resistance to CO2 compensation concentration and respiration. All the chemicals tested increased either mesophyll resistance or CO2 compensation point to various degrees. None of the chemicals tested acted solely on epidermal resistance. All chemicals reduced photosynthesis, but the ratio of photosynthesis to transpiration inbut the ratio of photosynthesis to transpiration in-creased in most cases in grapevine but not on citrus. Different chemicals acted differently in citrus and grapevine. The method of analysis used made it possible to evaluate separately the relative effect of a chemical on mesophyll resistance and respiration.—Copyright 1972, Biological Abstracts, W73-03192

DROUGHT RESISTANCE AND INTERNAL WATER BALANCE OF OAK SEEDLINGS, Forest Service (USDA), Bend, Oreg. Pacific Northwest and Range Experiment Station. K. W. Seidel. For Sci. Vol 18, No l, p 34-40. 1972. Illus.

For Sci. voir, 9, 80, 1974. 1972. Ims. Identifiers: Desiccation, "Drought resistance, "Oak-D, Quercus-Alba-D, Quercus-Rubra-D, Quercus-Velutina-D, Seedlings, "Transpiration, "Water balance.

The 2 components of drought resistance—drought tolerance (ability to withstand drought) and drought avoidance (ability to postpone drought) were measured on greenhouse-grown seedlings of white oak (Quercus alba L.), post oak (Q. stellata Wangenh.), black oak (Q. velutina Lam.), and northern red oak (Q. rubra L.). Leaf water characteristic curves, relating leaf water potential to leaf relative water content, were developed for the 4 species. The effect of decreasing soil and leaf water potential on the transpiration rate was deter-mined. Small reductions in leaf water potential in the range of -8 to -16 bars resulted in a large decrease in the transpiration rate attributed to sto-matal closure. Post oak was the most drought rematal closure. Post oak was the most drought re-sistant, primarily because of greater drought tolerance of leaf and root cells. Black oak and white oak differed little in tolerance and avoidance. Drought avoidance of red oak leaves was significantly lower than that of the other spe-cies, and drought tolerance of red oak roots was the lowest of the 4 species.—Copyright 1972, Biological Abstracts, Inc. SALT MIGRATION INTO THE ATMOSPHERE DURING TRANSPIRATION.

G. E. Nemeryuk. Fiziol Rast, Vol 17, No 4, p 673-679, 1970, English

summary.
Identifiers: Ammonium, Atmosphere, Calcium, Chloride, Polyethylene film, *lons, Magnesium, Migration, Particles, Potassium, Salts, Sodium, Sulfates, *Transpiration, Vapor.

In laboratory experiments various plants were put into a hermetical Plexiglas chamber, and vessels with soil were isolated by polyethylene film. Under field conditions, a soil plot with or without plants was closely covered with a polyethylene film. In both sets of experiments transpiration vapors were condensed on a cooled surface. The content of chloride, sulfate, ammonium, K, Na, Ca and Mg ions was determined in the condensates. Considerable amounts of all ions were found in the condensates after the experiment. Their total amount varied from 6 to 19 mg. The concentration of each ion was statistically reliable and exceeded the limit of sensitivity of the analytical methods applied. The presence of Ca2+ in the condensates was confirmed in the experiments with Ca45. Ion content in the condensates obtained under field conditions over plants was in all cases higher than in the condensates over soil without plants. According to the equivalent content in the condensates cations and anions can be arranged in the following series: Ca2+>Na+>Mg2+>K+ and HCO3->SO42>Cl-, respectively. Water vapors, evolved into at-mosphere during transpiration contain ion-salt particles of 10-8 in size.-Copyright 1972, Biological Abstracts, Inc. W73-03206

2E. Streamflow and Runoff

WATER BALANCE OF THE KARA-BATKAK GLACIER BASIN (VODNYY BALANS LED-NIKOVOGO BASSEYNA NA PRIMERE LED-NIAUVOGO BASSEYNA NA PRIMERE LED-NIKA KARA-BATKAK), Akademiya Nauk Kirgizskoi SSR, Frunze. Tyanshanskaya Vysokogornaya Fiziko-Geograficheskaya Stantsiya. For primary bibliographic eatry see Field 02C. W73-02635

WATER RESOURCES DATA FOR COLORADO. 1971: PART 1. SURFACE-WATER RECORDS. Geological Survey, Lakewood, Colo. For primary bibliographic entry see Field 07C. W73-02643

JET BOAT - TELLUROMETER TECHNIQUE FOR MEASURING STREAMFLOW IN LARGE

FOR MEASURING STREAMFLOW IN LARGE RIVERS, Department of the Environment, Ottawa (On-tario). Inland Waters Branch. For primary bibliographic entry see Field 07B. W73-02646

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1970,

Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 07C. W73-02652

FLOOD PROFILES IN THE UMPQUA RIVER BASIN, OREGON, PART I, Geological Survey, Portland, Oreg. For primary bibliographic entry see Field 07C.

Group 2E-Streamflow and Runoff

WATER RESOURCES OF THE MINNESOTA RIVER-HAWK CREEK W SOUTHWESTERN MINNESOTA, Geological Survey, Washington, D.C. WATERSHED, For primary bibliographic entry see Field 07C. W73-02663

EXPERIMENTAL INVESTIGATION HYDRAULIC TRANSIENTS IN RIVER-RESE-RVOIR SYSTEMS, PHASE III, Tennessee Univ., Knoxville. Water Resources Research Center.
For primary bibliographic entry see Field 08B. W73-02706

THE DECAY AND STABILITY OF INTERNAL WAVE MODES IN A MULTISHEETED THER-

MOCLINE, Reading Univ. (England). Dept. of Geophysics. For primary bibliographic entry see Field 05G. W73-02759

EDDY DIFFUSION COEFFICIENTS DUE TO IN-STABILITIES IN INTERNAL GRAVITY

WAVES, Toronto Univ. (Ontario). Dept. of Physics. C O Hines

Journal of Geophysical Research, Space Physics, Vol 75, No 19, p 3937-3939, July 1, 1970. 4 ref.

Descriptors: *Geophysics, *Mathematic models, Atmospheric physics, Air, Density, Viscosity.
Identifiers: *Waves, *Eddy diffusion, Kinematic viscosity, Thermal conductivity, Gravity waves.

In a recent paper, Hodges determined the maximum effective eddy diffusion coefficient K sub D that might be produced by turbulence from plane internal atmospheric gravity waves, without a decrease in the upward amplitude of the waves. The numerical solutions obtained by Hodges can be represented with great accuracy with another relation which has the advantage of yielding K sub D directly rather than as a root of a seventh-order polynomial, and it yields immediately a parametric form applicable to conditions other than those for which Hodges' numerical results were computed. It might on occasion be found useful because of these qualities. (Oleszkiewicz-Vanderbilt) W73-02776

PROBABILITY OF EXCEEDING CAPACITY OF FLOOD-CONTROL SYSTEM AT THE NA-TIONAL REACTOR TESTING STATION,

Geological Survey, Idaho Falls, Idaho. For primary bibliographic entry see Field 04A. W73-02781

WATER RESOURCES DATA FOR GEORGIA-

Geological Survey, Atlanta, Ga. For primary bibliographic entry see Field 07C.

EQUIVALENT ROUGHNESS FOR SHALLOW

Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
For primary bibliographic entry see Field 08B. W73-02786

BRINK DEPTH FOR TRAPEZOIDAL BROAD-

-CRESTED WEIR, Indian Inst. of Tech., Kharagpur. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B. W73-02788

MEASUREMENTS OF TURBULENCE IN WATER AT HIGH VELOCITY,
Arizona Univ., Tucson. Dept. of Systems En-

gineering. S. C. Ko.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, p 2253-2257, December 1972. 3 fig, 5 ref.

Descriptors: *Turbulence, *Water measurement, *Flow measurement, *Anemometers, Flowme-ters, Velocity, Current meters, Calibrations, Identifiers: *Hot-film anemometers.

Measurements of turbulence were made in a water tunnel at a high velocity, 2.44 m/s to 10.7 m/s. The rigidity of hot-film probes does not present any problem. Even in the case of a cylindrical hot-film, which has a diameter of 0.0254 mm, the sensor did not break at a velocity of 10.7 m/s. The parabolic probe gave very satisfactory results. At higher probe gave very satisfactory results. At higher velocity, vibration of the probe support becomes a problem. However, this can be minimized. In addition, the parabolic hot-film probe has no problem with vortex shedding and contaminant cumulation. The effects of water contamination on the performance of the probe were not investigated, but the repeatability of the probe gave very good consistency in city, water measurements. (Knapp. sistency in city water measurements. (Knapp-W73-02790

AN APPLICATION OF MULTI-VARIATE ANALYSIS IN HYDROLOGY, Colorado State Univ., Fort Collins. Environmental

Resources Center

V. Yevjevich, M. Dyhr-Nielsen, and E.-F. Schulz. Available from the National Technical Informa-tion Service as PB-213 625, \$3.00 in paper copy, \$0.95 in microfiche. Colorado Environmental Resources Center Completion Report Series No 35, August 1972, 39 p, 2 fig, 15 tab, 21 ref. OWRR A-009-COLO (2) 14-31-0001-3506.

Descriptors: *Geomorphology, watersheds, *Floods, Mathematical Model studies. *Small studies.

Multivariate analysis was used to make a selection Multivariate analysis was used to make a selection of some of the more meaningful physical parameters dealing with the response of a small watershed to flood-producing rainfall. Factor Analysis, Principal Component Analysis and a Correlation Coefficient Matrix were utilized. The list of 24 parameters was reduced to 8 parameters. This reduction results in a substantial economy in the encoding of relevant geomorphological data in flood analysis. W73-02873

ROTATIONAL STABILITY IN DILUTE POLYMER SOLUTIONS, Delaware Univ., Newark. Water Resources

Available from the National Technical Information Service as PB-213 626, \$3.00 in paper copy, \$0.95 in microfiche. Research Project Technical Completion Report, August 1972, 9 p, 6 fig, 7 ref. OWRR A-009-DEL (2).

Descriptors: *Drag, *Polymer, Rheology, *Stabili-

Identifiers: *Drag reduction, *Transport properties, Viscometry.

Dilute aqueous solutions of certain polymers have transport properties which differ considerably from those of pure water. It is shown how engineering estimates of regions where polymer solu-tion elasticity will be important can be made by comparing the shear wave velocity and the relevant kinemetical velocity. The transition from laminar shearing flow in plane Poiseuille and rota-tional Couette geometries is related to solution rheological properties using linear and non-linear stability theory, and verified experimentally for the Couette flow. Torque reduction in the Couette geometry is explained using a non-linear analysis. Rheological properties in dilute solutions can be estimated from the onset and torque of the secondary flow in the rotational Couette geometry. Cellular secondary flow is absent in a parallel-disk secondary. geometry. W73-02874

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FLOOD HYDROGRAPHS FOR UNGAGED STREAMS, Washington State Water Research Center, Pull-

D. L. Bender.

13. L. Bender. Available from the National Technical Informa-tion Service as PB-213 629, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, November 1972, 12 p, 1 fig, 2 tab, 24 ref. OWRR A-039-WASH (2).

Descriptors: *Floods, *Hydrographs, *Unit hydrographs, Runoff, *Storms, Estimating, Rain-fall-runoff relationships, Flood forecasting.

A method for determining flood hydrographs for small, ungaged streams is presented. The intensity-duration-frequency rainfall data are combined with a series of unit hydrographs to determine a series of possible flood hydrographs. The largest flood hydrograph is selected as the critical one. The unit hydrograph the control of the post hydrograph is selected as the critical one. flood hydrograph is selected as the critical one. The unit hydrographs are obtained from a general dimensionless unit hydrograph. The upper limit on the possible range of unit hydrographs appears to be critical. This upper limit for various basin characteristics has not yet been established. In order to use the method now, published methods estimating the average unit hydrograph peak must be used. It is determined that the selection of the unit hydrograph peak is more critical for short dube used. It is determined that the selection of the unit hydrograph peak is more critical for short duration storms than for long duration storms. It is also shown that for small basins, the short intense storms are the most important and as the size of the basin increases, the larger, less intense storms become more important. W73-02880

EXPERIMENTAL INVESTIGATION OF CON-VERGING OVERLAND FLOW, Agricultural Research Service, Fort Collins, Colo. D. A. Woolhiser, M. E. Holland, G. L. Smith, and

R. E. Smith.

American Society of Agricultural Engineers Transactions, Vol 14, No 4, p 684-687, July-August 1971. 1 fig, 1 tab, 8 ref.

Descriptors: *Overland flow, *Model studies, *Hydrograph analysis, Discharge (Water), Recession curves, Unsteady flow, Runoff, Rainfall-runoff relationships.

Identifiers: *Kinematic wave theory.

Experimental equilibrium hydrographs of over-land flow from a converging surface with a 5 per-cent slope agree reasonably well with those pre-dicted by kinematic theory if both laminar and tur-bulent flow regimes are included. If only one rebulent flow regimes are included. If only one resistance law is used, errors during recession may be as great as plus or minus 20 percent for this simple configuration. The simplest friction law that can be used in the kinematic model to predict rising and recession hydrographs from smooth surfaces must include the retarding effects of raindrop impact as well as defining regimes of laminar and turbulent flow. Such a law may require a minimum of three to four empirically determined parameters. A rapid drop in discharge during the recession indicates that a laminar to turbulent recession indicates that a laminar to turbulent transition occurred during the steady-state case. The shape of recession hydrographs predicted by kinematic theory is observed in experimental data. This shows that there is no general basis for the commonly accepted negative exponential recession. (Knapp-USGS)
W73-03018

Groundwater-Group 2F

EXTENSION OF THE FLOW-NET METHOD TO UNSTEADY INTERNAL AND EXTERNAL

UNSTEADY INTERNAL AND EXTERIFICATION OF THE PROPERTY OF THE PR

THE MAGNITUDE OF SHEAR STRESSES ACT-THE MAGNITUDE OF SHEAR STRESSES ACTING ON THE BOTTOM OF OPEN CHANNELS BY PROPAGATING SURGE WAVES, Slovenska Akademie Vied, Bratislava (Czechoslovakia). Ustav Hydrologie a Hydrauliky. For primary bibliographic entry see Field 08B. For primary W73-03038

NON-STEADY FLOW ON SLOPING BEACH WITH LARGE ROUGHNESS ELEMENTS, North Carolina State Univ., Raleigh. J. L. Machemehl, and J. B. Herbich.

J. L. Machemeni, and J. B. Heroich.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 177-186, 1972 (release date). 9 fig, 6 ref.

Descriptors: *Beaches, *Surf, *Currents (Water), Turbulence, Roughness (Hydraulic), Air entrain-ment, Waves (Water), Drag, Hydrodynamics,

As part of the comprehensive study of wave runup on smooth and rough, single and composite slopes, velocity distributions of non-steady flows stopes, velocity distributions of non-steady flows around and over large roughness elements were determined. The water uprush and downrush velocities parallel to the slope were measured and dimensionless velocities were plotted as a function of mean wave energy density. The reduction in the uprush velocity component (measured parallel to the slope) is primarily due to (a) an increase in form drag, (b) an increase in air entrainment, and (c) an increase in the intensity of turbulence caused by large roughness elements. A method of predicting wave forces on large roughness ele-ments is described. (Knapp-USGS)

VEGETATION, RUNOFF, AND SEDIMENT YIELD RELATIONSHIPS, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05B. W73-03067

AERATION OF WEIRS, College of Engineering, Madras (India). Dept. of Hydraulic Engineering. For primary bibliographic entry see Field 08B. W73-03142

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR COW BAYOU, BRAZOS RIVER BASIN, TEXAS, 1970, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W73-03147

ANNUAL COMPILATION AND ANALYSIS OF ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, TEXAS METROPOLITAN AREA, 1970, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C.

SOLUTION OF CONTINUITY AND MOMENTUM EQUATIONS OF A TRAVELLING HYDRAULIC JUMP BY USING AN ITERATIVE OPERATOR,
For primary bibliographic entry see Field 08B.
W73-03150

MAP SHOWING DRAINAGE BASINS AND HISTORIC CLOUDBURST FLOODS IN THE SALINA QUADRANGLE, UTAH, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-03152

2F. Groundwater

GEOLOGY AND GROUND WATER OF THE PAJARO VALLEY AREA, SANTA CRUZ AND MONTEREY COUNTIES, CALIFORNIA. Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 04B.
W73-02653

THE AVAILABILITY OF GROUND WATER IN NEW CASTLE COUNTY, DELAWARE, Delaware Univ., Newark. Water Resources For primary bibliographic entry see Field 04B. W73-02785

GRAVITATIONAL AND DISPERSIVE MIXING IN AQUIFERS, Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering. L. W. Gelhar, J. L. Wilson, and J. S. Miller Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, Paper 9439, p 2135-2153, December 1972. 7 fig, 2 tab, 12 ref, append

Descriptors: "Mixing, "Artificial recharge, "Dispersion, "Recharge wells, Path of pollutants, Injection wells, Stratified flow, Water quality, Density stratification, Convection, Groundwater movement, Hydraulics, Water storage.

Analytical techniques were developed to describe the mixing between two fluids of different density in a confined aquifer, in which one fluid is in-troduced to the aquifer by well recharge. The im-miscible displacement process in radial flows was analyzed. The effects of longitudinal and lateral dispersion are included using a boundary layer ap-proximation. The theoretical results were comared with observations of aquifer mixing in a pared with observations or aquirer management laboratory model. Excellent agreement between the theoretical predictions and experimental results was found. Theoretical predictions of recovery efficiency during a recharge-storage-withdrawal cycle show trends similar to those observed, but are somewhat lower. Direct theoretical predictions of recovery efficiency were developed for an immiscible system. (Knapp-USGS) W73-02791

SPECIFIC CAPACITIES OF WELLS IN CRYSTALLINE ROCKS, New Mexico Inst. of Mining and Technology, Socorro.

For primary bibliographic entry see Field 04B. W73-02800

NEW TECHNIQUE FOR ESTIMATING RECHARGE USING A DIGITAL MODEL, Geological Survey, Lakewood, Colo. For primary bibliographic entry see Field 04B.

ROLE OF VERTICAL SHAFTS IN THE MOVE-MENT OF GROUND WATER IN CARBONATE

Cave Research Foundation, Yellow Springs, Ohio. R. W. Brucker, J. W. Hess, and W. B. White. Ground Water, Vol 10, No 6, p 5-13, November-December, 1972. 9 fig. 1 tab, 17 ref.

Descriptors: *Karst hydrology, *Karst, *Sinks, *Supercritical flow, *Aeration, Caves, Carbonate

rocks, Drainage effects, Groundwater movement, Subsurface drainage, Hydrogeology, *Kentucky, Erosion, Scour, Solubility. Identifiers: *Vertical shafts (Karst).

Vertical shafts are roughly cylindrical voids in car-bonate rocks. They range in diameter from inches to tens of feet and in height from inches to hun-dreds of feet. They are produced by vertically descending groundwater from perched ground-water reservoirs or surface water. These features are common throughout the Interior Lowlands and Appalachian Plateaus Provinces. Vertical shafts form the headwater termini of complex drainage restructive that secretarians are restricted. form the headwater termini of complex drainage networks that aggregate the waters into master drains which carry the water to big springs. The drains evolve through time as base level is lowered but retain a dendritic pattern. Shafts are very short lived and occur only near the edge of the clastic caprock in the study area in south-central Kentucky. Shafts are formed by free-flowing sheets or films of vadose water streaming down the walls in supercritical flow. These waters are undersaturated with respect to calcite at both top and bottom of the shaft, although there is a measurable uptake of CaCO3 as the water traverses the shaft w The shafts act as aeration chambers, and there is much loss of carbon dioxide from the groundwater during movement through this segment of the un-derground route. (Knapp-USGS) W73-02803

THE AVAILABILITY OF GROUND WATER IN EASTERN SUSSEX COUNTY, DELAWARE, Delaware Univ., Newark. Water Resources Center. For primary bibliographic entry see Field 04B. W73-02805

THE AVAILABILITY OF GROUND WATER IN KENT COUNTY, DELAWARE, WITH SPECIAL REFERENCE TO THE DOVER AREA, Delaware Univ., Newark. Water Resources For primary bibliographic entry see Field 04B. W73-02806

GROUND-WATER RESOURCES AND GEOLO-GY OF COOK COUNTY, GEORGIA, Geological Survey, Atlanta, Ga. For primary bibliographic entry see Field 04B. W73-02807

REGIONAL HYDROGEOLOGIC INVESTIGA-TIONS IN KAZAKHSTAN (REGIONAL'NYYE GIDROGEOLOGICHESKIYE ISSLEDOVANIYA V KAZAKHSTA

Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-stitut Gidrogeologii i Gidrofiziki. For primary bibliographic entry see Field 04B. W73-02809

GROUNDWATERS OF KAZAKHSTAN AND RECOMMENDATIONS REGARDING THEIR USE IN THE NATIONAL ECONOMY FOR 1976--80 (PODZEMNYYE VODY KAZAKHSTANA I REKOMENDATSII PO IKH ISPOL'ZOVANIYU V NARODNOM KHOZYAYSTVE V PERIOD S

V NARODNOM RHOZZATSIVE V PERIOD S 1976 PO 1980 G.), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-stitut Gidrogeologii i Gidrofiziki. For primary bibliographic entry see Field 04B. W73-02810

PROSPECTS OF USING GROUNDWATERS ALONG THE IRTYSH RIVER NEAR SEMIPALATINSK IN THE NATIONAL ECONOMY (PERSPEKTIVY ISPOL-ZOVANIYA PODZEMNYKH VOD SEMIPALATINSKOGO PRIIRTYSH'YA V NARODNOM KHOZYAYSTVE), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki.

Group 2F-Groundwater

For primary bibliographic entry see Field 04B. W73-02812

MONITORING GROUNDWATER RESERVOIRS MONITORING CROUNDWATER RESERVOIRS
IN PIEDMONT PLAINS OF TIEN SHAN
(UPRAVLENIYE REZHIMOM PODZEMNYKH
VOD NA PREDGORNYKH RAVNINAKH TYAN'
SHANYA),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii Gidrofiziki.
For primary bibliographic entry see Field 04B.
W73-02815

W73-02815

OCCURRENCE OF GROUNDWATER IN THE PIEDMONT ALLUVIAL PLAIN ON THE NORTHERN SLOPE OF DZUNGARIAN ALA TAU (FORMIROVANIYE PODZEMNYKH VOD PREDGORNOGO SHLEYFA SEVERNOGO SKLONA DZHUNGARSKOGO ALATAU), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki. For primary bibliographic entry see Field 04B. W73-02816 OCCURRENCE OF GROUNDWATER IN THE

GROUNDWATER OF THE AKDALA RIVER VALLEY AND PROSPECTS OF ITS USE AS A WATER-SUPPLY SOURCE (PODZEMNYYE VODY DOLINY R. AKDALA I PERSPEKTIVY IKH ISPOL'ZOVANIYA DLYA VODOSNABZ-

HENIYA), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki. For primary bibliographic entry see Field 04B. W73-02817

THERMODYNAMIC ANALOGY OF MASS TRANSPORT PROCESSES IN POROUS MEDIA, Illinois Univ., Urbana. Dept. of Mining, Metallur-

Illinois Univ., Orbana. Dept. of Mining, Metallurgy and Petroleum Engineering.

A. E. Scheidegger, and K. H. Liao.
In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, NY, Elsevier Publishing Company, p 3-13, 1972. 12 ref.

Descriptors: *Mass transfer, *Porous media, *Groundwater movement, *Soil water movement, *Thermodynamics, Hydrodynamics, Path of polutants, Mathematical studies, Stutistics, Statistical methods, Diffusion, Dispersion, Statistical models, Equations,

An analogy between thermodynamics and massransport processes may be used to solve problems of transport in porous media. The stochastic theoretical models of porous media leading up to a general statistical treatment of the mechanics of flow through porous media are described. The thermodynamic interpretation of large mechanical systems can also be applied to transport processes in general and flow through porous media in particular. Important corollaries bearing upon the staticular. Important corolaries obearing upon the sta-bility conditions for displacement processes in porous media are reviewed. Based on the theories available, a front between displacing and displaced fluid is always unstable (that is, it grows indefinite-ly). (Knapp-USGS) W73-02319

STATIONARY HEAT TRANSPORT BY PLANE GROUNDWATER MOVEMENT IN A THIN OR A THICK LAYER, Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering. A. Verruij. In: Fundamentals of Transport Phenomena in

Porous Media; International Association for Hydraulic Research Developments in Soil Science 2, New York, N Y, Elsev p 25-35: 1972. 4 fig, 7 ref. evier Publishing Company, Descriptors: "Heat transfer, "Groundwater move-ment, "Mass transfer, Mathematical studies, Con-duction, Dispersion, Diffusion, Convection, Cool-ing, Heated water, Water temperature, Cooling water, Equations, Porous media.

For the use of groundwater for cooling purposes, systems of sources and sinks are often operated in confined aquifers. The water extracted at the sink is put back into the soil at the source. The mechanisms by which the groundwater flowing from source to sink loses part of its heat are analyzed. The problem can be treated in a general way, provided that heat transport by conduction or dispersion in the plane of flow is disregarded. (Knapp-USGS)

ON THE CORRELATION OF ELECTRICAL CONDUCTIVITY PROPERTIES OF POROUS SYSTEMS WITH VISCOUS FLOW TRANSPORT

COEFFICIENTS, Minnesota Univ., Minneapolis. Dept. of Geology

Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics. H.-O. Pfannkuch. In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 42-54: 1972. 1 fig, 28 ref.

Descriptors: *Electrical studies, *Porous media, *Permeability, *Porosity, *Electrical well logging, Electrical conductance, Groundwater, Electrical properties, Pores, Hydraulic conductivity, Pore water, Groundwater movement, Soil water movement, Viscosity, Equations.

Surface conductivity is important in electrical transport processes in porous media. This term has to be included in the calculations where phase distributions or porosities are to be deduced from for-mation factor measurements, even in clean formamation factor measurements, even in clean formations when electrolyte concentrations are low. In
applying a parallel resistance model of conduction
processes through porous media, it can be demonstrated that the pertinent parameters are a conductivity ratio function and the extent of the internal
specific pore surface area. The conductivity ratio
function also depends on the nature of the internal
surface area which determines the mechanism of
charge fixation at the solid-solution interface.
Based on the assumption that electrical and
viscous flow paths in the porous medium are
identical, the electrical transport coefficients can
be connected to viscous flow parameters by introducing the Kozeny-Carman hydraulic radius
concept of porous interstices and linking the internal surface area term to the permeability of the nal surface area term to the permeability of the medium. (Knapp-USGS)

SOME ASPECTS OF HEAT AND MASS TRANSFER IN POROUS MEDIA, Technion - Israel Inst. of Tech., Haifa.

G. Dagan.

In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 55-64: 1972. 12 ref.

Descriptors: *Mass transfer, *Heat transfer, *Hot springs, *Convection, *Diffusion, Heat flow, Groundwater movement, Porous media, Disper-sion, Pore water, Soil water movement, Equa-Identifiers: *Israel.

The transport of heat and solutes by a fluid moving The transport of neat and solutes by a fluid moving through a porous matrix is a phenomenon of great interest practically and theoretically. The two transport phenomena are combined in the hot and sally springs of the Sea of Galilee. The research work is only at its beginning. A systematical derivation of the equations of flow in porous media with heat and mass transfer is given, and the different types of approximations used in applica-tions are discussed. Physical interpretation and estimates of order of magnitude, rather than in-tricate mathematical derivations, are emphasized. tricate mathema (Knapp-USGS) W73-02823

ON THE PLANE STEADY FLOW THROUGH INHOMOGENEOUS POROUS MEDIA, Academia R. S. R., Bucharest. Institutul de Mate-

matica.
St. I. Gheorghitza.
In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 73-85: 1972. 7 ref.

Descriptors: *Porous media, *Groundwater move-ment, *Hydrodynamics, *Mathematical studies, *Heterogeneity, Percolation, Soil water move-ment, Aquifer characteristics, Fluid mechanics, Mass transfer, Equations.

Mathematical studies describe several ideal cases of plane steady flow through inhomogeneous porous media. A homogeneous pervious medium may contain impervious media whose frontiers have no common points with the exterior frontier of the proper medium (impervious have no common points with the exterior frontier of the propers medium (impervious have no common points with the exterior frontier of the propers medium (impervious have no common propers). have no common points with the exterior frontier of the porous medium (impervious bodies completely included within a porous medium). Another principal type of inhomogeneity is characterized by the absence of the medium in a certain domain (the porous medium contains cavities). The fluid in the cavity can be considered either a perfect fluid or a viscous fluid. The discharge of the fluid passing through the cavity does not depend on the direction of velocity at infinity. The phenomenon of interference between cavities is analogous to the phenomenon of the interference of wells. (Knapp-USGS) W73-02824

A NUMERICAL STUDY OF THE NONLINEAR LAMINAR REGIME OF FLOW IN AN IDEALISED POROUS MEDIUM, James Cook Univ. of North Queensland, Townsville (Australia).

K. P. Stark. K. P. Stark.

In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 86-102: 1972. 11 fig, 2 tab, 17 ref.

Descriptors: *Groundwater movement, *Soil water movement, *Porous media, *Numerical analysis, *Laminar flow, Darcys law, Dupuit-Forchheimer theory, Mathematical studies, Equa-

Identifiers: *Nonlinear laminar flow, *Navier-

A technique is described for obtaining numerical A technique is described for obtaining numerical solutions of groundwater flow by solving the Navier-Stokes laminar flow equations for flow through a number of simplified and idealized porous materials. The solutions extend the treatment into the nonlinear flow range by retaining the inertia terms in the Navier-Stokes equations. Flows in the nonlinear regime are associated with nonzero Reynolds numbers and high velocities or pressure gradients. Although the retention of the inertia gradients. Although the retention of the inertia terms complicates the numerical analysis, this complication is offset by the detailed description of the flow characteristics which results-thus, or the How characteristics which results—thus, pressure, shear, velocity, streamline, and vorticity values at every point in the flow are automatically obtained; the form and shear drag on any particle, the resultant vortex pattern in the wake region and its growth with varying Reynolds numbers, the nonlinear inertia components of the flow and the hydrodynamic force distribution on any element of th Koz plific Forc of fle corp napp W73

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of the medium can all be evaluated; finally, the empirical relations of Darcy, Forchheimer, Kozeny and others can all be tested. The sim-Kozzny and others can ail be tested. In a sim-piffied model shows the sufficiency of Darcy's and Forchheimer's laws within their specified ranges of flow. A revised porosity function should be in-corporated in the Carman-Kozeny relation. (K-napp-USGS) W73-02825

PROBLEMS CONCERNING SOLUTION OF STEADY AND UNSTEADY GROUNDWATER FLOW BY STATISTICAL METHODS, Technical Univ. of Brno (Czechoslovakia). For primary bibliographic entry see Field 02G.

THE RECIPROCITY PRINCIPLE IN FLOW THROUGH HETEROGENEOUS POROUS THROUGH MEDIA, For primary bibliographic entry see Field 04B. W73-02827

ON THE FLOW OF TWO IMMISCIBLE FLUIDS IN FRACTURED POROUS MEDIA, Technion - Israel Inst. of Tech., Haifa

J. Bear, and C. Braester. In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 177-202: 1972. 10 fig, 17 ref.

Descriptors: *Porous media, *Fractures (Geologic), *Fracture permeability, *Groundwater movement, *Soil water movement, Saturated flow, Unsaturated flow, Cracks, Fissures (Geologic), Rock properties

The equations and parameters which describe immiscible displacement in a fractured porous medium are presented and discussed. The system of um are presented and discussed. The system of fractures, depending on their width and spacing and whether they are void or full of fine impervious material, may introduce a permeability which is much higher than that of the porous medium without the fractures. The only feasible way of analytically treating flow of fluids through porous media is by the continuum approach. According to this approach, the actual porous matrix filled with this approach, the actual porous matrix filled with a flowing homogeneous fluid is replaced by a ficti-tious continuum, to each mathematical point of which (whether in the solid or in the void space) medium parameters such as porosity or permea-bility are assigned. The values of these parameters at a point are obtained by taking the average of the local values of the considered parameters over a small volume for which the considered point is a centroid. In the continuum obtained by repeating this procedure for all points of the considered ins procedure for an points of the considered domain, all medium parameters vary continuously from point to point. In the same way continuously varying averaged fluid and flow parameters (e.g. saturation, pressure, velocity) may also be obtained (Knapp-USGS)

ON STABILIZATION OF FINGERS IN A SLIGHTLY CRACKED HETEROGENEOUS POROUS MEDIUM, Maharaja Sayajirao Univ. of Baroda (india). For primary bibliographic entry see Field 02G. W73-02830

THE TENSOR CHARACTER OF THE DISPER-THE TENSOR CHARACTER OF THE DISPERSION COEFFICIENT IN ANISOTROPIC
POROUS MEDIA,
Technische Hogeschool, Delft (Netherlands).
Dept. of Civil Engineering.
For primary bibliographic entry see Field 02G. W73-02831

ON THE DERIVATION OF A CONVECTIVE-DISPERSION EQUATION BY SPATIAL

-DISPERSION EQUATION BY SPATIAL AVERAGING,
State Univ. of New York, Buffalo. Dept. of Engineering Science.
R. R. Rumer, Jr.
In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 268-275: 1972. 2 fig, 9 ref.

Descriptors: *Dispersion, *Convection, *Porous media, *Mixing, Diffusion, Path of Pollutants, Groundwater movement, Soil water movement, Mass transfer, Mathematical studies. Identifiers: *Convective dispersion.

Dispersion coefficients or transport coefficients for porous media flow are defined utilizing the concept of a macroscopic control volume and the spatial averaging of quantities within the macro-scopic control volume. The resulting mass balance equation is compatible with the continuum apequation is compatible with the continuum approach normally employed in the analyses of fluid flow. For linear laminar flow the dispersion of conservative substances in flow through porous media is a result of the spatial velocity variations due to the complicated geometry of the pore system coupled with the molecular diffusion of the substance. substance across streamlines. The derivation of the mass balance equation is extended to include the mass balance equation is extended to include decay or disappearance of the substance. The mass balance equation (in dimensionless form) gives rise to two dimensionless groupings; namely the molecular Peclet number and the ratio of the dispersion coefficient to the effective molecular difference of the dispersion dispersion coefficient to the effective molecular diffusion coefficient for porous media flow. Beyond the linear laminar regime, the influence of viscosity becomes important in the dynamics of the flow field. Since the transport of a substance within the pore system is highly dependent upon the flow field, there results an implied dependence of dispersion coefficients upon the molecular viscosity of the host fluid. (Knapp-USGS) W73-02832 W73-02832

VERTICAL AND HORIZONTAL LABORATO-RY PERMEABILITY MEASUREMENTS IN CLAY SOILS,

Manchester Univ. (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 02G. W73-02833

THE FLOW OF AIR AND WATER IN PARTLY SATURATED CLAY SOIL, Manchester Univ. (England). Simon Engineering

For primary bibliographic entry see Field 02G. W73-02834

AN INVESTIGATION INTO THE FLOW BEHAVIOUR THROUGH COMPACTED SATU-RATED FINE-GRAINED SOILS WITH REGARD TO FINES CONTENT AND OVER A RANGE OF APPLIED HYDRAULIC GRADIENTS, University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering. For primary bibliographic entry see Field 02G. W73-02835

NON-DARCIAN FLOW OF WATER IN SOILS--- LAMINAR REGION, Technical Univ. of Prague (Czechoslovakia). Soil

For primary bibliographic entry see Field 02G. W73-02836

HYDROSTATICS AND HYDRODYNAMICS IN

SWELLING MEDIA,
Commonwealth Scientific and Industrial Research
Organization, Canberra (Australia). Div. of Plant

For primary bibliographic entry see Field 02G. W73-02837

MODEL TESTS TO STUDY GROUNDWATER FLOWS USING RADIOISOTOPES AND DYE

FRACERS, Gesellschaft fuer Strahlenforschung m.b.H., Mu-nich (West Germany). Institut fuer

D. Klotz, H. Moser, and W. Rauert. D. Klotz, H. Moser, and W. Rauert.
In: Fundamentals of Transport Phenomena in
Porous Media; International Association for
Hydraulic Research, Developments in Soil
Science 2, New York, N Y, Elsevier Publishing
Company, p 356-367: 1972. 10 fig. 4 tab, 11 ref.
Atomic Energy Agency Vienna (Contract No 259/RB).

Descriptors: *Model studies, *Hydraulic models, **Groundwater movement, Porous media, Tracers,
Dye releases, Radioisotopes, Soil water movement, Hydraulic similitude, Laboratory tests.

To study the behavior of groundwater flows, in particular in the vicinity of wells, two types of flow models were built on a scale of 1:1. The aquifer is simulated by quartz sands and gravels with grain sizes between 0.5 and 1.5 mm, 2 and 4 mm, and 4 and 6 mm. Intake and discharge of water are symmetrical through inlets and outlets distributed evenly over the end walls, and across stilling chambers. Throughflow is regulated by suming chambers. Incommon is regulated by overflow tanks and valves and measured by float flow meters. Filtration velocities are regulated between 1.5 mm/day and 60 m/d. Tracers measure the velocity distribution over the cross section of the models; potential distribution can be followed continuously by pressure measuring points on the bottom and on the walls. Both measurements revealed a constant velocity over the model cross section. (Knapp-USGS) W73-02838

SORPTION IN FLOW THROUGH POROUS

Utah Water Research Lab., Logan. For primary bibliographic entry see Field 02G. W73-02839

SHALLOW AQUIFERS RELATIVE TO SUR-SHALLOW AUTERS NORTH PLATTE RIVER VAL-LEY, GOSHEN COUNTY, WYOMING, Wyoming Univ., Laramie. Dept. of Geology. For primary bibliographic entry see Field 04B. W73-02900

DEVELOPMENT OF GROUND-WATER RESOURCES IN THE ORANGE COUNTY AREA, TEXAS AND LOUISIANA, 1963-71, **GROUND-WATER** Geological Survey, Austin, Tex. For primary bibliographic entry see Field 04B. W73-03139

2G. Water in Soils

EFFECTS OF DETERGENT POLLUTED WATER ON SOIL REACTION AND PLANT GROWTH, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. For primary bibliographic entry see Field 05C. W73-02620

SOIL ASSOCIATIONS AND LAND CLASSIFI-CATION FOR IRRIGATION, LINCOLN COUN-

TY, New Mexico Agricultural Experiment Station, University Park. For primary bibliographic entry see Field 03F. For primary W73-02623

Group 2G-Water in Soils

DYNAMICS OF NITRIC AND AMMONIA NITROGEN ACCUMULATION IN THE SOIL, IN THE INTERVAL BETWEEN WATERING IN THE CASE OF SPRINKLING AND BED IR-RIGATION OF MAIZE, Issi (Rumania). For primary bibliographic entry see Field 03C. W73-02669

THERMODYNAMIC ANALOGY OF MASS TRANSPORT PROCESSES IN POROUS MEDIA, Illianis Univ., Urbana. Dept. of Mining, Metallur-gy and Petroleum Engineering. For primary bibliographic entry see Field 02F. W73-02819

STATIONARY HEAT TRANSPORT BY PLANE GROUNDWATER MOVEMENT IN A THIN OR

Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering. For primary bibliographic entry see Field 02F. W73-02820

THE SIGNIFICANCE OF THE NET TRANSFER OF VISCOUS STRESS ENERGY AND THE LOCAL PRODUCTION OF KINETIC ENERGY IN STATIONARY SOIL WATER FLOW, Agricultural Univ., Wageningen (Netherlands). Lab. of Soils and Fertilizers.

P. H. Groenevelt. In: Fundamentals of Transport Phenomena in in: rundamentais of fransport recomena in Porous Media; International Association for Hydraulic Research, Develogments in Soil Science 2, New York, N.Y., elsevier Publishing Company, p 36-41: 1972. I fig. 4 ref.

Descriptors: *Groundwater movement, *Ther-modynamics, *Hydrodynamics, Mathematical studies, Porous media, Soil water movement, Permeability, Darcys law, Equations. Identifiers: Navier-Stokes Equation.

For stationary saturated flow of water through a homogeneous porous medium, nonequilibrium thermodynamics provides a scheme in which measurable fluxes and forces are connected to each other by linear homogeneous relationships. This set of relationships infers the existence of coupling phenomena and constitutes the main virtue of this phenomena and constitutes the main virtue or this branch of science, a proposed equality of 'twin' cross coefficients. Especially for systems with intricate geometry this way of treating cross phenomena seems to be promising. To come to a correct and useful set of fluxes and forces a small content of the property of subsystem within the liquid phase may be deter-mined and integrated over a larger volume of the porous system. Disappearance of 2 nonlinear terms then leads to a useful linear relationship between the filter flux and the gradient of the hydraulic head; however the existence and the magnitude of the two terms of concern in the dissipation function before integration predicts the lack of a linear relationship between the flow velocity and the local gradient of the hydraulic head. (Knapp-USGS) W73-02821

ON THE CORRELATION OF ELECTRICAL CONDUCTIVITY PROPERTIES OF POROUS SYSTEMS WITH VISCOUS FLOW TRANSPORT COEFFICIENTS,

Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics. For primary bibliographic entry see Field 02F.

W73-02822

SOME ASPECTS OF HEAT AND MASS TRANSFER IN POROUS MEDIA, Technion - Israel Inst. of Tech., Haifa. For primary bibliographic entry see Field 02F. W73-02823

ON THE PLANE STEADY FLOW THROUGH INHOMOGENEOUS POROUS MEDIA, Academia R. S. R., Bucharest. Institutul de Mate-

matica. For primary bibliographic entry see Field 02F. W73-02824

A NUMERICAL STUDY OF THE NONLINEAR LAMINAR REGIME OF FLOW IN AN IDEALISED POROUS MEDIUM, James Cook Univ. of North Queensland, Townsville (Australia). Proprimary bibliographic entry see Field 02F. W73-02825

PROBLEMS CONCERNING SOLUTION OF STEADY AND UNSTEADY GROUNDWATER FLOW BY STATISTICAL METHODS, cal Univ. of Brno (Czechoslovakia).

V. Halek, and M. Novak. In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 103-118: 1972. 3 fig, 12 ref.

Descriptors: *Statistical methods, *Statistical models, *Numerical analysis, *Soil water movement, Steady flow, Unsteady flow, Groundwater movement, Saturated flow, Unsaturated flow, Un saturated flow. Porous media.

Statistical methods of solving problems of groundsatisfical methods of solving protocean or ground-water flow in a pervious medium consisting of parallel layers are reviewed. Stratification may be inclined. The plane flow may be affected by the elastic deformation of pervious medium and by water accumulation at the limit of free water level water accumulation at the initial of tree water level movement. By means of linearized equations it is possible to describe the unsteady flow in a region closed by a curve along which a boundary condition is given. A special case of a stationary process shows the possibility of using Green's function as a physical interpretation of the flow. The statistia physical interpretation of the flow. The statistical procedures have practical advantages because they do not require a large capacity of computer memory. The algorithm of the solution is very simple and it is good even in the inhomogeneous regions of flow. (Knapp-USGS) W73-02826.

ON THE FLOW OF TWO IMMISCIBLE FLUIDS IN FRACTURED POROUS MEDIA, Technion - Israel Inst. of Tech., Haifa. For primary bibliographic entry see Field 02F.

W73-02828

COEFFICIENTS FOR SALT AND WATER FLOW THROUGH CLAYS,

Hebrew Univ., Rehovoth (Israel). Dept. of Soil

Science.
A. Banin.
In: Fundamentals of Transport Phenomena in
Porous Media; International Association for
Hydraulic Research, Developments in Soil
Science 2, New York, NY, Elsevier Publishing
Company, p 212-220: 1972. 2 fig, 1 tab, 11 ref.

Descriptors: *Mass transfer, *Clays, *Osmosis, *Ion exchange, *Ion transport, Translocation, Diffusion, Membranes, Thermodynamics, Porous media, Soil water movement, Groundwater movement, Saline water, Water chemistry, Aguicludes, Aquitards, Membrane processes.

A friction model was applied to clay systems in which steady flow of salt and water, in response to salt concentration gradients, was taking pl sait concentration gradients, was taking place. In recessary equations are presented. A detailed set of data from flow experiments in Na-montmorillonite was used to calculate the friction coefficients of the moving species. The magnitude and mode of variation of the friction coefficients was correlated with the extent of electrical double layer interaction in the pores of the clay plug. (Knapp-USGS)

ON STABILIZATION OF FINGERS IN A SLIGHTLY CRACKED HETEROGENEOUS POROUS MEDIUM, Maharaja Sayajirao Univ. of Baroda (India).

In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 221-228: 1972. 2 fig, 12 ref.

Descriptors: *Porous media, *Mixing, *Oil-water interfaces, *Statistical methods, Saturated flow, Unsaturated flow, Mathematical models, Numeri-

The problem of the stability of fingers in oil-water displacement processes was examined statistically for percolation in a slightly cracked heterogeneous porous medium. A perturbation procedure was employed for the analytical solution of the equation of motion. The perturbation solution does produce 'stable fingers' in at least one special case. (Knapp-USGS)
W73-02830

THE TENSOR CHARACTER OF THE DISPER-SION COEFFICIENT IN ANISOTROPIC POROUS MEDIA, Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering. G. De Josselin de Jong.

G. De Josselin de Jong.
In: Fundamentals of Transport Phenomena in
Porous Media; International Association for
Hydraulic Research, Developments in Soil
Science 2, New York, N Y, Elsevier Publishing
Company, p 259-267: 1972. 3 fig, 5 ref.

Descriptors: *Dispersion, *Porous media, *Anisotropy, *Stochastic processes, Diffusion, Tracers, Groundwater movement, Soil water movement, Path of pollutants, Mass transfer. Identifiers: *Dispersion tensors.

A method is discussed for determination of concentration distribution developing from a point injection of tracer particles if these are carried away by the fluid flow through the porous medium. The resulting concentration distribution is almost normal (Gaussian), in all directions, with the points of standard deviation lying on an ellipsoid. This con-centration distribution can be uniquely defined by its mean point and the variances or second central movements with respect to the three space coordinates. The variances can be considered as the components of a second rank tensor. The variance of dispersion for the general anisotropic case is a tensor of infinite rank; therefore the dispersion constant is also a tensor of infinite rank. As a consequence of this fact the differential equation for dispersion developed for the isotropic case can be generalized to the anisotropic case only by introducing a dispersion coefficient, whose dependence on the direction of flow is expressed by a serious of infinite terms. (Knapp-USGS) W73-02831

ON THE DERIVATION OF A CONVECTIVE--DISPERSION EQUATION BY SPATIAL AVERAGING, State Univ. of New York, Buffalo. Dept. of En-

gineering Science. For primary bibliographic entry see Field 02F.

W73-02832

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VERTICAL AND HORIZONTAL LABORATO-RY PERMEABILITY MEASUREMENTS IN CLAY SOILS, Manchester Univ. (England). Dept. of Civil En-

Manchester Onev. (England). Dept. of Civil Engineering.
W. B. Wilkinson, and E. L. Shipley.
In: Fundamentals of Transport Phenomena in
Porous Media; International Association for
Hydraulic Research Developments in Soil Science
2, New York, N. Y. Elsevier Publishing Company,
p 285-298: 1972. 11 fig, 1 tab, 23 ref.

Descriptors: *Permeability, *Hydraulic conductivity, *Clays, *Compaction, Creep, Porous media, Leaching, Compressibility, Consolidation, Pressure, Soil physical properties, Pore water. Soil water movement, Stress, Viscosity, Plasticity, Groundwater movement.

The consolidation behavior of a clay may be influenced by the effect of decreasing permeability-compressibility and structural viscosity (creep properties) during a test. A number of theories to take account of these variable soil properties for both vertical and horizontal consolidation show that the vertical and horizontal compressibility are decreased; but fine tickoff the behality are not constant but functions of the permeability and not constant but functions of the permeability and compressibility changes during a test and the creep properties of the soil. In view of the importance of vertical and horizontal hydraulic conductivities in relation to consolidation studies, vertical and radi-al permeameters were designed to enable direct measurements to be made at the intermediate stages between the application of pressure incre-ments in a consolidation test. In all the direct tests Darcy's law was found to be valid. The flow rate: hydraulic gradient relationships are all inear and pass through the origin. Darcy's law was also valid at all effective stress levels for samples permeated with natural pore water collected from the site (the natural pore water contained 0.58% NaCl by weight with traces of calcium and magnesium salts). (Knapp-USGS) W73-02833

THE FLOW OF AIR AND WATER IN PARTLY SATURATED CLAY SOIL, Manchester Univ. (England). Simon Engineering

L. Barden, A. O. Madedor, and G. R. Sides.

L. Barden, A. O. Madedor, and G. K. Sides. In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 299-311: 1972. 7 fig., 12 ref.

Descriptors: *Unsaturated flow, *Clays, *Soil water movement, *Permeability, Saturated flow, Wetting, Pores, Pore water, Diffusion, Consolidation, Compaction, Porous media, Soil physical

In soils of low clay content, the values of air and water permeability are functions of the structure and saturation. Both of these are complex parameters, particularly structure which may contain various levels of micro- and macrostructure; and this in turn complicates the concept of saturation, since the micropores may be saturated and the macropores unsaturated. Both permeabilities are dominated by the macropores and their degree of dominated by the macropores and their degree of saturation; however, at low degrees of saturation water permeability is influenced by the microstructure. Occlusion can be caused by decreasing the suction or increasing the applied stress. In both cases air permeability greatly exceeds water permeability up to occlusion showing that pore pressure dissipation from soils with continuous air pressure dissipation from soils with continuous air voids is governed by air permeability. Following occlusion air permeability is meaningless and transport of air is by a slow diffusion process. Water permeability now controls drainage and is influenced by the size of the air bubbles in the macropores, but the effect does not appear great. The value of air permeability decreases very abruptly as the last trace of suction is removed and

occlusion finally occurs when the suction reaches zero. (Knapp-USGS) W73-02834

AN INVESTIGATION INTO THE FLOW BEHAVIOUR THROUGH COMPACTED SATU-RATED FINE-GRAINED SOILS WITH REGARD TO FINES CONTENT AND OVER A RANGE OF APPLIED HYDRAULIC GRADIENTS.

APPLIED HYDRAULIC GRADIENTS, University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering. J. S. Younger, and C. I. Lim. In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y. Elsevier Publishing Company, p 312-326: 1972. 10 fig, 2 tab, 25 ref.

Descriptors: *Darcys law, *Porous media, *Clays, *Soil water movement, *Particle size, Unsaturated flow, Hydraulic gradient, Ground-water movement, Permeability, Hydraulic conductivity, Soil properties, Pores, Permeameters.

A short review is given of investigations of the validity of Darcy's law as applied to flow through soil systems. The conditions of flow through laboratory-compacted, saturated fine-grained soils and the results of tests on samples with varying content of fine particles over the range of gradients 0.2 and 12.0 are discussed. Peak deviations from Darcy's law were obtained when the samples had a fines content of about 30% when using a single size type of coarse grading. Using a well-graded coarse fraction the trends were more complex. The evidence suggests particle migra-tion, particularly since the clay contents, and hence clay structural effects, were small. Mostly test runs were initiated at a gradient of 1 but a few tests used even small gradients. For greater amounts of fines a more complex pattern was evident; non-Darcian behavior occurred until gradients of about 2 were applied. Similar trends were evident whether the compaction conditions were wet or dry. The similar trends suggested that a critical gradient of the order of 1 to 2 for these gradings and soil type was required to effect considerable migration. Clay particle structure would have little effect on the compaction conditions except at the highest fines contents used. (Knapp-USGS) W73-02835

NON-DARCIAN FLOW OF WATER IN SOILS. -- LAMINAR REGION, Technical Univ. of Prague (Czechoslovakia). Soil

Science Lab. M. Kutilek.

In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 327-340: 1972. 2 fig. 1 tab, 44 ref.

Descriptors: "Soil water movement, "Rheology, "Porous media, "Darcys law, "Laminar flow, Hydraulic conductivity, Unsaturated flow, Saturated flow, Permeability, Flow, Particle size, Clays, Pores, Capillary action, Viscosity. Identifiers: "Non-Darcian flow.

Experimental and theoretical studies of non-Darcian flow in soils are reviewed. A hypothesis frequently used for the explanation of non-Darcian flow in the laminar region is based on the al-tered viscosity of water in soil caused by the influence of the soil solid surface. A quasi-crystalline arrangement of water molecules may exist in the proximity of the solid surface. Water in capillathe proximity of the soins surface. Water in capital-ries may have the properties of a Bingham body. The electrical streaming potential effect is one of the possible causes of the non-Darcian flow. The direction of the gradient of the electrical streaming potential as induced by the flow of water is op-posite to the direction of the hydraulic gradient. Non-Darcian flow can probably be caused by Non-Darcian flow can probably be caused by change of the geometric arrangement of particles inside of the soil sample. In the case of transport of small particles in coarse pores, either gradual blocking of outflow channels of big pores, or unblocking of inflow channels into big pores can octur. Flowing water also acts upon the compression of the sample, which is opposed by the swelling pressure. (Knapp-USGS)
W73-0285

HYDROSTATICS AND HYDRODYNAMICS IN

SWELLING MEDIA,
Commonwealth Scientific and Industrial Research
Organization, Canberra (Australia). Div. of Plant
Industry.
J. R. Philip.
In: Fundamentals of Transport Phenomena in

J. R. Phup.

In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y. Elsevier Publishing Company, p 341-355: 1972. 1 fig, 46 ref.

soils, *Unsaturated flow, Unsteady flow, Infiltra-tion, Percolation, Soil mechanics, Hydrodynam-ics, Porous media, Hydraulic conductivity, Darcys

Hydrodynamics and hydrostatics of unsaturated nonswelling media, particularly 'diffusion analy-sis' developed in mathematical soil physics are discussed. This approach may be generalized to two- and three-component horizontal systems in swelling media. Generalization to vertical systems demands consideration of hydrostatics in swelling media. The total potential includes, in this case, in media. The total potential includes, in this case, an additional component, the overburden potential.

There are three types of equilibrium profile: hydric profiles with the moisture gradient <0; pycnotatic profiles with gradient ±0; and xeric profiles with gradient>O. Both hydric and xeric profiles with gradient>O. Both hydric and xeric profiles approach the pycnotatic state (of maximum apparent specific gravity) in depth. Classical concepts of groundwater hydroiogy (tacitly based on the behavior of nonswelling media) fail completely for swelling media. The nonsteady vertical flow equation is derived. It is shown how its solution leads to the theory of one-dimensional infiltration in swelling media. (Knapp-USGS) W73-02837

MODEL TESTS TO STUDY GROUNDWATER FLOWS USING RADIOISOTOPES AND DYE

TRACERS, Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut Radiohydrometrie. For primary bibliographic entry see Field 02F. W73-02838

SORPTION IN FLOW THROUGH POROUS MEDIA, Utah Water Research Lab., Logan. D. W. Hendricks.

D. W. Hendricks.

In: Fundamentals of Transport Phenomena in Porous Media; International Association for Hydraulic Research, Developments in Soil Science 2, New York, N Y, Elsevier Publishing Company, p 384-392: 1972. 4 fig. 5 ref.

Descriptors: *Sorption, *Porous media, *Mass transfer, *Ion transport, *Kinetics, Path of pollu-tants, Dispersion, Diffusion, Mixing, Chemical reactions, Water chemistry, Absorption.

In one-dimensional flow of a dissolved solute through a saturated homogeneous porous media, in which the solute sorbs on the granular material, in which the solute soros on the granular materia, the concentration of that solute species in the liquid phase and in the solid phase will vary with time and distance. The fundamental principles relevant to the solutions in time and space for both solid and liquid phases are outlined. Such solutions

Group 2G-Water in Soils

are useful in designing and in specifying operation of ionuexchange and adsorption columns, and in evaluating the movement characteristics of a groundwater contaminant. The elements of the overall problem are readily delineated by a conventional mass balance analysis on a column slice of infinitesimal thickness. The kinetic mechanisms involved are: (1) chemical reaction kinetics: (2) involved are: (1) chemical reaction kinetics; (2) involved are: (1) chemical reaction kinetics; (2) liquid phase diffusion; and (3) solid phase diffusion. A fourth kinetic mechanism is convective-dispersion. Computer solutions of kinetic equations are compared with several measured profiles. The computer solutions behaved in an identical manner to the measured solutions when the same variations in room temperature and flow rate were imposed. (Knapp-USGS)

SOIL COMPLEXES IN THE EAST OF THE BREST POLESIE, (IN RUSSIAN), I. S. Lupinovich, and N. K. Chertko. Vesta Beloruss Univ. Ser. 2. 3, p 67-72. 1969. Identifiers: *Brest Polesie (USSR), Mineralization, Relief, Rock, *Soils, Texture, USSR, Vegetation, Soil moisture.

The following soil sequence was observed: sod podzolic soil with normal moisture contents on elevations through sod podzolic-gleyey and sod gley soils on slopes and low areas, humus-gley and sod-calcareous bogged soils, to peat-bog soils on extensive lowlands. Formation of the soil complexes is controlled by relief, vegetation, texture of the soil-forming rocks, depth of occurrence and of the soul-forming rocks, depth of occurrence and chemical composition of groundwaters. The de-pendence of the acidity of soils and their base saturation on the degree of mineralization of groundwater is discussed.—Copyright 1972, Biological Abstracts, Inc.

BOUNDARY EFFECTS IN DESATURATION OF

POROUS MEDIA, Colorado State Univ., Fort Collins. N. F. White, D. K. Sunada, H. R. Duke, and A. T. Corey. Soil Science, Vol 113, No 1, p 7-12, January 1972. 6 fig, 1 tab, 7 ref.

Descriptors: *Unsaturated flow, *Porous media, *Laboratory tests, *Calibrations, Soil water movement, Groundwater movement, Boundary processes, Air-earth interfaces, Capillary action, Boundary Pores, Pore water, Porosity, Hysteresis, Satura-tion, Unsteady flow, Permeability.

The ratio of exposed surface area to volume of laboratory samples of porous media significantly affects the drainage characteristics of the samples. During the early stages of desaturation of an initially fully saturated porous medium, saturation is greater for a particular capillary pressure when the exposed surface area of a sample is reduced. The effect of the exposed surface area to volume ratio effect of the exposed surface area to volume ratio is confined to the stage of desaturation occurring before a porous medium is occupied by an interconnected gaseous phase. For isotropic media, the gaseous phase first becomes interconnected at a capillary pressure such that the rate of desaturation with respect to increase in capillary pressure is a maximum. The effect of the exposed surface area during the early stage of desaturation is a second surface. area during the early stage of desaturation is a result of penetration of air into pores exposed at the boundary of the sample. Because porous media in the field usually have a relatively small ratio of exposed surface area to volume, it would be appropriate to reduce this ratio as much as possible on laboratory samples used to obtain capillary pressure-desaturation data. (Knapp-USGS) W73-03064

AVAILABLE WATER CAPACITIES OF ZAMBI-AN SOILS IN RELATION TO PRESSURE

PLATE MEASUREMENTS AND PARTICLE SIZE ANALYSIS, Zambia Dept. of Agriculture, Chilanga. A. H. Maclean, and T. U. Yager. Soil Science, Vol 113, No 1, p 23-29, Januray 1972. 5 fig, 2 tab, 20 ref.

Descriptors: *Soil moisture, *Laboratory tests, *Moisture tension, *Moisture availability, Moisture stress, Moisture content, Soil texture, Particle size.
Identifiers: *Zambian soils.

The object was to determine for Zambian soils, the most suitable pressure plate pressures to substitute for field capacity and wilting point, and to establish relationships for prediction of moisture characteristics from easily measurable soil components including particle size and organic carbon contents. Although 1/3 atmosphere has been commonly substituted for field capacity, it leads to underestimation of available water over a wide range of textures. For Zambian soils 1/10 or 1/20 atmospheres should normally be used as the upper limit of available water, and this may apply to similar soils in other areas. Fifteen atmospheres The object was to determine for Zambian soils, the similar soils in other areas. Fifteen atmospheres can satisfactorily be substituted for wilting point. Equations involving particle size and organic carbon fractions can be used to give an approximate estimate of available water in these soils. Any improvement in estimation from soil components must entail subdivision of the particle sizes and perhaps inclusion of structural differences. (K-napp-USGS) W73-03065

A METHOD FOR THE DETERMINATION OF THE THERMAL PROPERTIES OF SOIL NEAR THE SURFACE,
Bari Univ. (Italy). Istituto di Geodesia e Geofisica.

Bart Omv. (taby), issuited on decodesia e deorisisca. F. Mongelli, G. Zito, and M. Loddo. Archiv fur Meteorologie, Geophysik und Biokli-matologie, Ser. A., Vol 20, No 1, p 35-42, 1971. 1 tab, 4 fig, 6 ref.

Descriptors: *Thermal conductivity, Soil investigations, *Air-earth interfaces, *Soil physical properties, *Soil tests, *Soil temperature, Diffusivity, Thermal capacity, Energy budget, Evapotranspiration, Evaporation, On-site data collections, Transmissivity, Energy dissipation, Methodology, Soil physics, Soil moisture, Laboratory tests. tory tests.

For many years, the measurement of diffusivity volumetric heat capacity, and particularly thermal conductivity has been carried out by the cylindriconductivity has been carried out by the cylindrical heat source inserted into the soil. However, this method does not allow a very reliable measure of thermal conductivity in the uppermost soil layer. A new method (a variant of that established by Mongelli), based on the heating of the soil surface by a flat spiral of electric wire, and on the record of temperature rise at a shallow depth, is presented. This method has the following favorable features; 1) simpler heating technique of the soil surface, 2) readings of the temperature rise at a single depth in the soil, 3) elimination of any imperfect contact between the heater and the soil surface, 4) short duration of the experiment limiting any external influence, 5) elaboration simplicity of the experimental data, and 6) lateral heat ty of the experimental data, and 6) lateral heat cy or use experimental data, and 6) lateral heat losses check. The application of the method is demonstrated by laboratory experiments as well as by experiments in situ. (Black-Arizona) W73-03076

A HYDROPHILIC POLYMER AS A SOIL AMENDMENT, Arizona Univ., Tucson. Environmental Research

M. H. Jensen, and R. Eikhof

In: Proceedings, Tenth National Agricultural Plastics Conference, Chicago, Illinois, p 69-79, November 1971. 4 tab, 3 fig, 1 ref.

Descriptors: "Polymers, Soil investigations, Soil chemistry, "Soil amendments, "Soil treatment, "Soil mechanics, "Moisture availability, "Additives, Soil-water-plant relationships, Arid lands, Water conservation, Crop production, Soil physics, Soils, Soil physical properties.

physics, Soils, Soil physical properties.

In most arid regions, water scarcity becomes the crucial constraint upon agriculture. A considerable portion of irrigation water ordinarily dissipates below the root zone or evaporates from the surface. A step toward greater productivity with less water might be a soil additive that makes nearly all this water more available to crops. An experimental hydrophilic polymer was tested as an amendment to sand. The compound was mixed with the sand at various rates or placed as a band at various depths. With the amendment, significantly less water was required to produce tomato and red kidney bean. The fresh weight of tomato transplants was as much as 106 percent greater than that from non-amended sand. Bean plants growing in the amended sand withstood a six-day induced drought without showing signs of wilt; yet those in sand alone reached permanent wilting point. It may be possible that this material could be economically banded into the soil along with fertilizer, thereby enhancing crop production as well as allowing more efficient use of water and fertilizer. Such a material has tremendous possibilities for use in desert regions where the goal would be to produce higher yields with limited water supply. (Black-Arizona) W73-03098

VIRUS-SIZED PARTICLE ADSORPTION ON SOIL-PART I: RATE OF ADSORPTION, Oregon State Univ., Corvallis. Dept. of Civil Engineering. For primary bibliographic entry see Field 05B. W73-03177

EFFECT OF AN ASPHALT BARRIER ON WATER REDISTRIBUTION AFTER INFILTRA-TION IN SANDY SOILS, Minnesota Univ., St. Paul. Dept. of Soil Science. J. P. Palta.

M.S. Thesis. 1971. 67 p, 16 fig, 3 tab, 8 ref. OWRR B-015-MINN (5). 14-01-0001-1916.

Descriptors: "Soil water, "Soil water movement, "Drought, Sands, Soils, "Minnesota. Identifiers: "Asphalt barrier, "Holding capacity of soil, "Suction changes, Soil water redistribution.

Asphalt barriers have been shown to increase the water holding capacity of the soil, reduce nutrient losses, and increase crop yields. This study was undertaken to determine from soil water retention properties the extent to which drought frequency was reduced in east central Minnesota by asphalt barriers in sandy soils and the properties of the asphalt barrier that influence water movement. Field measurements of water redistribution after infiltration were made on Zimmerman fine sand and on Hubbard sandy loam. A laboratory study of the transmission properties of an asphalt barrier was made using undisturbed barrier samples excavated from Zimmerman fine sand. The following conclusions are drawn. A well formed asphalt barrier can double the amount of water stored in a uniform sandy profile. It is less effective in layered soils, particularly when it is underlain by a Asphalt barriers have been shown to increase the uniform sandy profile. It is less effective in layered soils, particularly when it is underlain by a course gravel layer in the profile. On a probability basis in half the years the number of drought days will be reduced by 22 to 25 days on Zimmerman fine sand underlain with barrier in east central Minnesota. Transmission of water through an asphalt barrier is unlike that through a granular, porous medium. Water flow through an asphalt barrier takes place mainly through pores and fissures formed due to initial imperfection, root growth, freezing and thawing of the soil and shrinkage of the barrier. Pores and fractures in the asphalt barrier may be empty or filled with soil. Empty pores have a nonzero contact angle. (Walton-Minnesota) W73-03

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Tr Inst E p 117-123 Identifie Dynamic Minerals Taiga, Tr Peat soils higher gr N, P, K t imum res of the gro of N, P, water tab crease. T most ma water lev

SOILS O THE POSTURAL UY. V. Fed Tr Kaz N 316, 1970. Identifier Agricultu tivation, l ties, Piedr

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Soils of p derlain b depths. T lowness o humus and cm. The n the surface tention, p creased de cal proper composition lain by bou 70 cm are while thos shallow de cultivated properties discussed. W73-03209 W73-03189

INFLUENCE OF SHAPE OF IMPLEMENTS ON SOIL STRUCTURE, Indian Inst. of Tech., Kharagpur. L. S. Bhushan, and B. P. Ghildyal. Indian J Agric Sci, Vol 41, No 9, p 744-751, 1971,

Identifiers: *Cultivation, *Soil physical proper-ties, Clod, Distribution, Implements, Shape, Size, Soils, Structure.

Each implement has its own characteristic clod-size distribution because of the shape of its cutting tool. The curvature of an implement is an impor-tant design parameter. It is closely related to the mean weight diameter of the clod, which in turn affects the volume-weight, prorsity, infiltration capacity and water-storage capacity. The mean weight diameter of the clod appears to be the best single soil physical parameter for evaluating the performance of tillage implements.—Copyright 1972, Biological Abstracts, Inc.

DYNAMICS OF NUTRIENTS IN RELATION TO THE HYDROLOGICAL REGIME OF SOILS IN BOG FORESTS OF THE SOUTHERN TAIGA IN THE TRANSURALS (IN RUSSIAN),

Tr Inst Ekol Rast Zhivotn Ural Fil Akad SSSR. 67,

17 Inst. Exon Rast Zanvoin Ural Fu Asau SSSA. O., p. 117-123, 1970.
Identifiers: *Soil chemical properties, *Bogs, Dynamics, Forests, Hydrological aspects, Minerals, Nutrients, Season, Soils, Southern Taiga, Transurals, USSR.

Peat soils of bog forests of the valley types, with higher groundwater tables, had higher contents of N, P, K than peat soils of water divides. The maximum reserve of nutrients in soils was found at the time of high groundwater tables, at the beginning of the growing season (June). The fall of water tables in July-Aug. was accompanied by a decrease of N, P, K in the soil, while the second rise of water tables in Sept. was accompanied by their in-crease. The contents of N and P underwent the most marked seasonal variations. The ground-water levels were not always strictly correlated with the contents of N, P, and K.--Copyright 1972, Biological Abstracts, Inc.

SOILS OF PIEDMONT DEBRIS CONES AND THE POSSIBILITIES FOR THEIR AGRICUL-TURAL UTILIZATION (IN RUSSIAN),

Y. V. Fedorin, and A. I. Iorganskii. Tr Kaz Nauchno-Issled Inst Zemled. 9/10, p 297-

316, 1970.
Identifiers: *Crop production, *Soil properties, Agriculture, Soil chemical properties, Cones, Cultivation, Debris, Irrigation, Soil physical properties, Piedmont, Soils.

Soils of piedmont debris cones are sierozems underlain by boulder-pebble deposits at varying depths. Their characteristic features are shallowness of the fine earth layer, low contents of humus and carbonates, and some claying at 40-60 cm. The nearer the boulder-pebble deposits are to the surface, the poorer the hydrophysical and chemical properties of soil (diminished water retention, porosity, water permeability, water-retention, porosity, water permeability, water-retention, porosity, water permeability, water-re-sistance of structure, nutrient contents, and in-creased density). These unfavorable hydrophysi-cal properties are due largely to the mineralogical composition (montmorlilonite). Sierozems under-lain by boulder-pebble deposits from a depth of 60man or sounder-peoble deposits from a depth of 60-70 cm are recommended for sugar beet rotations while those with the boulder-pebble deposits at a shallow depth are recommended for cereals and cultivated grass. The effect of cultivation on soil properties and the irrigation regimen and rates are discussed.—Copyright 1972, Biological Abstracts, Inc. Inc. W73-03209

SOILS OF NORTHERN TURKMENISTAN AND SOME OF THEIR AGRICULTURAL FEATURES (IN RUSSIAN),

D. Gurtmurtov.

D. Curtumurov. Uch Zap Turkm Gos Pedagog Inst Ser Estestv Nauk. 34, p 191-227, 1970. Identifiers: *Soil properties, Agriculture, Classifi-cation, Genesis, Northern, Soils, *Turkmenistan, USSR.

The soils consisted of the following genetic groups, types and varieties: hydromorphic-incipient, meadow, irrigated, meadow, bog soils, and secondary solonchaks, solonchaks, semihydromorphic, irrigated, meadow, takyr soils; automorphic-takyr, irrigated, desert, sandy, and gray brown soils. Brief descriptions of the soils are provided.—Copyright 1972, Biological Abstracts, Inc.
W73-03210

CONDENSATION PROCESSES IN NON-I-RRIGATED SOILS (IN RUSSIAN), M. I. Rubinshtein.

Tr Kaz Nauchno-Issled Inst Zemled. 9/10, p 327-338, 1970

John 1970. Identifiers: *Condensation, *Soil properties, Hygroscopicity, Moisture, Nonirrigated soils, Soils, USSR.

During the spring-summer period, the surface layers are colder at night than the underlying layers, and in the daytime they become desiccated below maximum hygroscopicity. The relative atbelow maximum hygroscopicity. The relative at-mospheric humidity rises at night. Rich soil is dominated by intrasolum condensation of water vapor. Mean diurnal condensation for the 0-10-cm layer is 0.2 mm in May, 0.4 mm in June, 0.21 mm in July and 0.19 mm in Aug; it reaches 1-2 mm for the 0-30-cm layer. Intrasolum condensation is most ac-tive in loose, moisture-rich soil. In the daytine water vapor migrates to deeper layers. Water vapor circulation in the diurnal cycle involves the vapor circulation in the diurnal cycle involves the 0-100-cm soil layer. Making a compacted intercalation in the loose arable layer facilitates the condensation and preservation of moisture.—Copyright 1972, Biological Abstracts, Inc.

W73-03211

HYDROPHYSICAL CHARACTERISTICS OF TYPICAL SIEROZEM IN THE YAVAN VALLEY (IN RUSSIAN),

(IN RUSSIAN),
T. M. Drozbzhia, and E. V. Chapovskaya.
Tr Tadzh Nauchno-Issled Inst Pochvoved, Vol 13,
No 2, p 69-74, 1970.
Identifiers: *Soil physical properties, Bulk, Coefficients, Density, Hygroscopicity, Permeability,
Porosity, Sierozem, Specific gravity, USSR, Wilting, *Yavan Valley.

The soils are light and medium loams. Their specific gravity varies with the horizons, within 2.71-2.76. Their bulk density is comparatively low, 1.1-1.2, indicating weak differentiation of the profile. Total porosity is high, 55-60%, throughout the profile. The root zone possesses optimum active capillary porosity (>20 vol. %). Inactive porosity (diameter <3 microns) varies from 21.9 to 30.9% over the profile. The limited variations in maximum hygroscopicity (3.6-4.7) and wilting percentage (4.4-6.9%) from 1 horizon to another is explained by textural uniformity. Field capacity vapianed by textural uniformity. Field capacity va-The soils are light and medium loams. Their plained by textural uniformity. Field capacity va-ries from 19 to 26% over the profile, increasing with depth. These are subsidence soils, with a low permeability coefficient (0.0439-0.005 cm/min) and a low water yield (2.5-4.1 vol. percentage).— Copyright 1972, Biological Abstracts, Inc. W73-03212

EXTERNAL FRICTION COEFFICIENT OF SIEROZEM (IN RUSSIAN),

A. R. Dardzhimanov. Tr Tadzh Nauchno-Issled Inst Pochvoved, Vol 13, No 2, p 110-119, 1970. Identifiers: *External friction coefficient, *Soil moisture, Pressure, *Sierozem. The external friction coefficient (EFC) of sierozem depends upon moisture and normal pres-sure. The minimum value occurs at the minimum moisture content of the arable layer. As the moisture content increases, EFC increases, up to a point; any further increase in the moisture content causes a decrease of EFC. EFC decreases with in-creasing normal pressure upon the soil. The moisture content of soil and EFC were found to be monstructionally related, the relationship following the equation of a 2nd-order parabola. EFC values calculated from this equation were close to experimental values in all cases. If the moisture content of a soil is known, the EFC values can be calcu-lated from the equation.—Copyright 1972, Biologi-cal Abstracts, Inc.

THE CONTENTS OF TRACE ELEMENTS IN ERODED SOD PODZOLIC SOILS FORMED ON MORAINIC DEPOSITS IN THE POOZER'E (LAKE AREA) OF BELORUSSIA (IN RUSSIAN), A. G. Medvedev, L. F. Vashkevich, and L. M. Yaroshevich.

Vestn Beloruss Univ. 2. 1, p 73-75, 1970.

Identifiers: *Soil chemical properties, Belorussia, Lakes, Morainic deposits, Podzolic soils, Poozer'e, Sod, Soils, *Trace elements, Soil ero-

Data are given on texture, agrochemical properties, contents and distribution of trace elements in eroded sod podzolic soils. In an uneroded soil, the minimum content of trace elements occurs in the podzol horizon and the maximum content in the il-luvial (B1) horizon, which usually also has the maximum content of silt clay ('physical clay'). The contents of trace elements in uneroded soil can be arranged in the following series: Ti>Zr>Mn>Sr>Cr>V>Ni>Cu>B>Co. In series: eroded soils, the trace elements are redistributed over the profile depending upon the degree of ero-sion. The highest contents of trace elements occur in moderately eroded soils, while their lowest con-tents are in slightly eroded and overwashed soils, with heavily eroded soil in an intermediate posi-tion.—Copyright 1972, Biological Abstracts, Inc. W73-03214

COMPARATIVE CHARACTERISTICS OF OLD--IRRIGATED SIEROZEMS IN THE VAKHSH VALLEY WITH COMPACTED AND UNCOM-PACTED SUBARABLE HORIZONS (IN RUS-

For primar W73-03215 nary bibliographic entry see Field 03F.

2H. Lakes

THE OCCURRENCE AND POSSIBLE SOURCE OF THE COLIFORM BACTERIA ON THE SHORELINE OF NORTHERN LAKE

MICHIGAN,
Michigan State Univ., East Lansing. Dept. of
Microbiology and Public Health.
For primary bibliographic entry see Field 05B.
W73-02606

MERCURY POLLUTION OF GOLF COURSE LAKES, Missouri Water Resources Research Center, Columbia.

For primary bibliographic entry see Field 05B. W73-02615

MORPHOLOGY OF GLACIAL LAKE MERZ-BACHER AND MECHANICS OF ITS CATASTROPHIC OUTBURST (MOR-FOLOGIYA LEDNIKOVOGO OZERA MERT-

Group 2H-Lakes

SBAKHERA I MEKHANIZM YEGO KATAS-SBAKHERA I MEKHANIZM YEGO KAT TROFICHESKIKH PRORYVOV), Akademiya Nauk Kirgizskoi SSR, Fru Tyanshanskaya Vysokogornaya Fiz Geograficheskaya Stantsiya. For primary bibliographic entry see Field 02C. Frunze Fiziko-

WATER RESOURCES DATA FOR COLORADO, 1971: PART 1. SURFACE-WATER RECORDS. Geological Survey, Lakewood, Colo. For primary bibliographic entry see Field 07C.

GEOLOGY, SOILS, AND HYDROGEOLOGY OF VOLO BOG AND VICINITY, ILLINOIS.
Illinois State Geological Survey, Urbana. M. R. McComas, J. P. Kempton, and K. C. Hinkley.

Environmental Geology Notes, No 57, November, 1972. 27 p, 9 fig, 3 tab, 30 ref.

Descriptors: *Geology, *Hydrogeology, *Soil properties, *Illinois, *River basins, Investigations, Data collections, Hydrologic data, Bogs, Surface waters, Lakes, Water levels, Groundwater, Precipitation (Atmospheric), Geocl Water resources, Environmental effects. Identifiers: *Volo Bog basin (III). Geochemistry,

The investigations of the geology, soils, and hydrogeology in the Volo Bog basin in Lake County, Illinois, provided basic knowledge of the physical conditions of the basin. The bog has been preserved for its unique botanical character, which evolved through a series of geologic and hydrologic events somewhat modified by the more recent activities of man. Continuance of the present hydrogeologic conditions within the basin would be essential to maintain the bog without further deterioration. Study of the glacial materials revealed the sequence of lake and bog develop-ment for the past 14,000 years. The bog has un-dergone periods as an ice-filled depression, an open-water lake, a shallow draining lake, a lake with continually rising water levels, a swamp-surrounded lake, and finally a shallow pond sur-rounded by tamarack forest. The basin is a groundwater discharge point for the surrounding uplands. The alkaline groundwater from the uplands is converted to acid water by the organic material in the bog. The acid water supports the growth of swamp sumac, tamarack, and sphagnum moss, which, with other plants, are typical of acid bogs. (Woodard-USGS) W73-02657

EXPERIMENTAL INVESTIGATION OF HYDRAULIC TRANSIENTS IN RIVER-RESE-RVOIR SYSTEMS, PHASE III, Tennessee Univ., Knoxville. Water Resources Research Center.
For primary bibliographic entry see Field 08B, W73-02706

TROUBLED WATERS, LAKE ERIE 1971, Social Technology Systems, Inc., Newton, Mass. For primary bibliographic entry see Field 05B. W73-02743

ROLE OF GROUNDWATER IN MAINTAINING THE LEVEL OF LAKE BALKHASH (ROL'
PODZEMNYKH VOD V PODDERZHANII
UROVNYA OZ. BALKHASH),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki. For primary bibliographic entry see Field 04B.

A COMPUTER PROGRAM FOR CALCULAT-ING NUTRIENT BALANCES, New York State Dept. of Environmental Conser-vation, Albany, Environmental Quality Research and Development Unit. For primary bibliographic entry see Field 07C. W73-02858

SOURCES OF NUTRIENTS IN CANADARAGO

LAKE, New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit. For primary bibliographic entry see Field 05C. W73-02859

SOLUBILIZATION OF INORGANIC PHOSPHATE BY BACTERIA ISOLATED FROM UPPER KLAMATH LAKE SEDIMENT, Oregon State Univ., Corvallis. Dept. Microbiology. For primary bibliographic entry see Field 05C. W73-02954

NEW DATA ON THE FAUNA OF NAIDIDAE (OLIGOCHAETA) OF LAKE BAIKAL, N. L. Sokolskaya.

Trans. available from the National Technical Information Service as PB-208 084T, \$3.00 in paper copy, \$0.95 in microfiche. Bu. of Sport Fisheries and Wildlife Translation, November, 1971. 37 p, 9 fig, 2 tab, 18 ref. Translated from Trudy Limitation of the Parker Service (VA) nologicheskogo Instituta, Vol 1 (XXI), No 1, p 127-151, 1962.

Descriptors: *Oligochaetes, Systematics, Distribution, Benthic fauna. Identifiers: *Lake Baikal (USSR), *Naidids, Lum-

Oligochaete fauna of Lake Baikal, USSR are characterized by high endemism and astonishing diversity of the little known family Lumbriculidae. Although there are previous records of Naididae, new collections made in 1957 and 1958 resulted in 47 qualitative and quantitative samples, 38 of which contained Naididae (1790 specimens) in depths up to about 20 m in open regions, bays connecting the lake, two gulfs, and pre-mouth sec-tions of four rivers. The taxonomic section gives tions of four rivers. The taxonomic section gives great detail, usually location, type of substrate, description, often including digestive system, blood system, setal apparatus, and reproductive system. New species are described. The data presented attest to a richer and more unique fauna presented attest to a richer and more unique fauna of oligochaetes than was previously known in Lake Baikal. These collections contain 16 species, 5 described as new and one representative of a new genus, and some forms of wide geographic distribution. In describing the new genus, it is thought that only investigation of the reproductive system will give bases for analysis of its phylogenetic connections in the future. The setae are distinctive in other cases. A key is given for determining genera and species of Naididae of Lake Baikal. (Jones-Wisconsin) W73-03016

SURFACE PHYTOPLANKTON AND SOME ASPECTS OF THE PHYSICAL-CHEMICAL LIMNOLOGY OF THREE AREAS ON LAKE

TEXOMA, Oklahoma Univ., Norman. Dept. of Zoology. R. E. Baglin, Jr. The Southwestern Naturalist, Vol. 17, No 1, p 11-19, May, 1972. 5 tab, 1 fig.

Descriptors: Limnology, "Phytoplankton, "Algae, "Reservoirs, Water chemistry, "Aquatic plants, "Cyanophyta, "Euglenophyta, "Pyrrophyta, Chlorophyta, Physicochemical properties, Lakes, Salinity, Conductivity, Sampling, Biochemistry, Alkalinity, Chemical analysis, Oklahoma, Texas.

Identifiers: *Lake Texoma.

Earlier work on Lake Texoma presented a list of plankton emphasizing bottom fauna. A study of surface phytoplankton and some physical and chemical conditions in three different areas on the lake are presented. The area with the highest lake are presented. The area with the highest salinity and highest conductivity had the greatest number of algal genera and greatest number of algal genera and greatest number of individuals present. Water temperature was about the same for each area. Thirty genera representing five phyla were identified. Chlorophyla genera were more prevalent than Cyanophyla in each collection. Bacillariophyla were present in each area. Phyrrohophyta and Euglenophyta preferred the area of highest salinity and turbidity. Genera present in each locality varied through time. (Black-Arizona) W73-03072 W73-03072

METHOD FOR DETERMINING NUMBER OF BACTERIA IN OOZE DEPOSITS OF WATER RESERVOIRS (IN RUSSIAN), For primary bibliographic entry see Field 05A. W73-03115

HYDROLOGIC RECONNAISSANCE OF BIG AND LITTLE SODA LAKES, CHURCHILL COUNTY, NEVADA, Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 07C. W73-03137

BATHYMETRIC RECONNAISSANCE OF BIG AND LITTLE WASHOE LAKES, WASHOE COUNTY, NEVADA, Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 07C. W72-03138

GREAT LAKES SIMULATION MODEL-A DECISION AID, Department of Energy, Mines and Resources, Cornwall (Ontario). Great Lakes-St. Lawrence

Study Office. R. L. Pentland, D. F. Witherspoon, and G. W.

In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 249-255, 29 August-3 September 1970. 7 p, 3 fig, 8 ref.

Descriptors: *Great Lakes, *Simulation analysis, *Model studies, *Decision-making, *Forecasting, *Reservoir operation, Flow, Dynamic programming, Synthesis, Hydrologic aspects, Time lag.

The application of simulation and mathematical programming techniques to the problems involved in regulation of the Great Lakes was discussed. In particular, the use of forecasting as an aid in operational decision making and simulation techniques to test alternative reservoir operating policies were emphasized. An attempt was made to demonstrate the interrelationships between the various models and sub-systems used. A hydrologic model of the basins was combined with a program describing the movement of water through the lake system for use in forecasting studies. The same routing model was used in conjunction with supply synthesis and dynamic programming techniques to develop and test reservoir operating policies for both existing and proposed configura-tions of control works. Preliminary results showed that the hydrologic lag time, both in the basin and in the lake system, could be described in mathe-matical terms and used as a basis for medium range lake level forecasting. (Veverka-Cornell)

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2I. Water in Plants

RELATIONSHIP OF PLANT MOISTURE STATUS TO IRRIGATION NEED IN CORN AND SOYBEAN CROPS,

Illinois Univ., Urbana. Water Resources Center.

J. S. Boyer.

Available from the National Technical Informa-tion Service as PB-213 502, \$3.00 in paper copy, \$0.95 in microfiche. Illinois Water Resources Center, Urbana, Research Report No 60, 1972, 35 p, 6 fig, 21 ref. OWRR B-036-ILL (10), 14-31-0001-3075.

Descriptors: *Photosynthesis, *Irrigation efficien-Descriptors: "Protosynthesis, "Irrigation efficien-cy, Moisture, Plant physiology, Crop production, Measurement, Leaves, "Moisture stress, "Corn (Field), "Soybeans. Identifiers: "Crop moisture status, "Leaf enlarge-le

ment, Chloroplast, Pressure chamber.

The objective was to develop a practical method of measurement of crop moisture status which could be used in the field and to interpret the measurements thereby obtained in terms of irrigation need. A small inexpensive pressure chamber was developed, tested, and shown to give reasonable accurate values for the moisture status of corn and soybeans. Laboratory simulation studies of corn and soybeans showed that during vegetative development leaf enlargement was more sensitive ght than photosynthesis and dark respiration. These parameters were correlated with pressure chamber measurements. It was therefore concluded that irrigation needs could be based on the maintenance of leaf enlargement alone. Chloroplast photosynthesis was studied and shown to be limiting photosynthesis in sunflower at low moisture availabilities. Studies of liquid water transport showed that soybean had a higher resistance to water movement than did corn or sunflower and that the high resistance was associated primarily with the roots. It was concluded that the moisture status of crops can be simply measured and interpreted at the practical level permitting efficient irrigation planning during vegetative development. W73-02604

THE COMPOSITION AND DISTRIBUTION OF THE FISH FAUNA OF THE NAVASOTA RIVER, Texas A and M Univ., College Station. Water Resources Inst.

For primary bibliographic entry see Field 08I.

PECULIARITIES OF THE PHYTOPLANKTON SPECIES COMPOSITION OF SOME FOREST

Polish Academy of Sciences, Krakow. Zakład

Biologii Wod. H. Bucka, and L. Krzeczkowska-Woloszyn.

Acta Hydrobiol. Vol 13, No 2, p 195-208, 1971. Il-

Identifiers: Desmids, Diatoms, *Forest ponds, *Phytopiankton, Pleurotaenium trabecula var sem undu, *Poland, Ponds, Species, Zooplankton.

A study was made on the characteristics of plankton from 6 forest ponds in the Opole province. It was generally composed of green algae and diatoms, with a considerable number of desmids. Among the algae, other species, associated with an acidified environment, were noted in great quantities. Some of the species are known in Poland in a few localities only, and Pleurotaenium trabecula var. semi-undulatum had never been noted before. Zooplankton was sparse. The composition of the algae demonstrated the dystrophic character of the investigated ponds.-Coppright 1972, Biological Abstracts, Inc. W73-02644

CONSIDERATIONS REGARDING DISTRIBU-TION OF PHYTOPLANKTON IN THE CRAPINA-JUILA MARSHY COMPLEX. (IN RUMANIAN), Bucharest Univ. (Rumania).

I. Gavrila

Commun Bot. 12. p 401-409. 1971. Illus. English

Jdentifiers: Crapina-Jijila, Macrophytes, Marsh,
*Phytoplankton, *Romania, Zooplankton,
*Danube floodplain.

Low water occurs between June-Oct. and high water between Oct.-June in this area on the Danube floodplain. Distribution is determined by chemical and physical water properties as well as by the macrophytes and zooplankton.—Copyright 1972, Biological Abstracts, Inc.

INVESTIGATIONS INTO THE FORMATION OF BIOGENETIC VERTICAL TURES IN THE SUR. HOLSTEIN, (IN GERMAN),

J. Koehnlein, and K. Bergt. Z. Acker Pflanz. Vol 133 No 4. p 261-198. 1971. Il-

Z Acter Pitiatz. Vol 133 No 4, p 201-198. 1971. Il-lus. Map. English summary. Identifiers: Biogenesis, Diked marshes, Forma-tion, *Germany, Marshes, *Roots, *Schleswig-Holstein, Soils, Vertical tubes (Plants).

The root structures of deeply rooted plants on pastures in the diked marshland area were studied. Drawings of the root systems are given. The origin of the vertical tubes found in the subsoil is discussed. The root development of pioneer plants in this area is also described by scale drawings.— Copyright 1972, Biological Abstracts, Inc. W73-02687

WATER CONSUMPTION IN THE GROWTH OF ORGANIC SUBSTANCES IN CERTAIN BIOCOENOSES IN THE SOUTHERN TAIGA, (IN RUSSIAN),

(IN RUSSIAN), V. V. Osipov. Lesovedenie. 2. p 96-98. 1971. English summary. Identifiers: Biocenoses, "Birch D, Grass M, Growth, Organic substances, "Rye M, Sorrel D, "Taiga, USSR, "Water consumption, Wood.

A total of 1200 g of water were consumed for the growth of 1 g of wood in wood-sorrel-grass-birch groves in the moraine loam of the Yaroslavsk reevaporate more than the grassy covering (sown rye).—Copyright 1972, Biological Abstracts, Inc. W73-02688

STUDIES ON THE PRODUCTIVITY OF THE PONDS OF UPPER BELGIUM: THE BIOLOGY LIMNEPHILUS LUNATUS (TRICHOPTERA),
Institut Royal des Sciences Naturelles de

Belgique, Brussels.

Bull Inst R Sci Nat Belg. Vol 47 No 40, p 1-9. 1971.

Identifiers: *Belgium, Limnephilus lunatus, Ponds, *Productivity (Inserts), *Trichoptera.

Egg-laying, egg number, and the duration of the different stages of development were studied in L. lunatus in the laboratory. A summer diapause in the larval stage was noted and was attributed to the temperature. The data obtained were com-pared to the cycle of the insect in nature.--Copy-right 1972, Biological Abstracts, Inc. W73-02689

THE ASSOCIATION OF LITTORELLA UNIFLORA AND ELEOCHARIS ACICULARIS IN THE 'ENTRE-SAMBRE-ET-MEUSE,'

J. Duvigneaud. Bull Soc R Bot Belg. Vol 104 No 2, p 235-252. 1971. Illus. English summary.

Identifiers: *Belgium, *Eleocharis acicularis M, Entre-Sambre-Et-Meuse, *France, *Littorella uniflora D, Plant communities.

The Littorello-Eleocharitetum Chouard 1924 was observed on the shores of 9 ponds situated in the Entre-Sambre-et-Meuse' (Belgium, province of Hainaut; France, departments of the Nord, the Aisne and the Ardennes). That plant community is regressing and appears to be becoming extinct in Belgium.—Copyright 1972, Biological Abstracts, Inc. W73-02691

THE WATER ECONOMY OF THE BILBERRY (VACCINIUM MYRTILLUS) UNDER WINTER

CONDITIONS, Oulu Univ. (Finland). Dept. of Botany.

Ann Univ Turku Ser A II Biol Geogr. 47. p 41-52.

Identifiers: *Bilberry D, Vaccinium myrtillus D, *Water economy (Plants), Winter, Forest zone.

The wintertime ecology, particularly the water economy and associated problems of a typical species of the boreal coniferous forest zone were investigated. The water content of the aerial shoots decreases, and the osmotic values and cold resistance increase in the autumn until around the turn of the year when a permanent snow cover is achieved. After that there is a change in the ecophysiology: adaptation to summer conditions begins as early as this. Bilberry is sensitive to the weather and for this reason it is not easy to ob-serve permanent regional differences of the ectotypic character. Ecophysiological changes do, however, take place at different times in different regions in accordance with the regional temperature. Even the aerial parts of the shoots are ble of absorbing water directly, for example from melting snow. Water uptake is slow in low temperatures, but it is ecologically significant at least in that it saves the shoots from possible crises due to lack in winter and early spring. In addition, when the shoots get sufficient water without risk of damage (no danger of dying from cold) they can adapt for the summer when still under the snow.-Copyright 1972, Biological Abstracts, Inc.
W73-02705

THE BIOLOGY OF A LANDLOCKED FORM OF THE NORMALLY CATADROMOUS SALMONIFORM FISH GALAXIAS MACULATUS (JENYNS): I. LIFE CYCLE AND ORIGIN, New South Wales State Fisheries, Sydney (Aus-

D. A. Pollard.

Aust J Mar Freshwater Res. Vol 22, No 2, p 91-123, 1971, Illus.

123. 1971. Itus.
Identifiers: *Catadromous salimoniform fish,
Fish, *Galaxias maculatus, Landlocked form
(Fish), Life cycle (Fish), *Reproduction.

G. maculatus, the common jollytail of Australia and 'whitebail' of New Zealand, is normally catadromous throughout its range (south-eastern Australia, New Zealand, and southern South America). In some athalassic inland lakes on the volcanic plains of south-western Victoria, howvolcanc plains of south-western Victoria, how-ever, a number of populations apparently descended from this species have become landlocked. The life cycle of the form inhabiting one of these lakes (the 'landlocked jollytail' of Lake Modewarre) may be summarized as follows: Gonadal maturation in the adult fish, which live in the slightly saline landlocked lake, begins around March and is almost completed by about June. The final stage of maturation is not reached, however, until these fish migrate short distances up intermittent inflowing creeks when the latter begin to flow in late winter and spring (July-Oct.). Spawning takes place when the creeks are swollen after heavy rain, the eggs being deposited among flooded vegetation in shallow areas of slow-flowing water along the creek banks. Many of the spent

Group 21-Water in Plants

fish die after spawning. The eggs, which are stranded when the flood-waters subside. develop stranded when the flood-waters subside, develop among the vegetation on the banks above the normal water level. After development is complete reimmersion by the first flood to cover them stimulates hatching. The normal developmental period is probably about 2 wk, but in the absence of flooding hatching can be delayed up to at least a month after fertilization. The newly hatched larvae are washed downstream into the lake where they feet and growt to majority. They migrate up. vae are washed downstream into the state where they feed and grow to maturity. They migrate up-stream to spawn in the following late winter-early spring season at an age of approximately 1 yr. The fish grow to about 9 cm in their first yr, 14 cm in their second, and 17 cm in their third yr. The average size of the females is greater than that of average size of the remains is greater than that of the males. The general features of the life history of this landlocked form are compared and con-trasted with those of the stream-dwelling species G. maculatus and a number of other salmoniform O. macuatus and a numeer of other samonatorm fishes. The geological origin of the complex of lakes in south-western Victoria inhabited by landlocked galaxiid populations is discussed, and an hypothesis concerning the origin of the Lake an appointess concerning the origin of the Lake Modewarre form from an ancestral population of G. maculatus in the Barwon-Leigh River system is advanced. (See also W73-02856)—Copyright 1972, Biological Abstracts, Inc. W73-02855

THE BIOLOGY OF A LANDLOCKED FORM OF THE NORMALLY CATADROMOUS SAL-MONIFORM FISH GALAXIAS MACULATUS (JENYNS): II. MORPHOLOGY AND SYSTE-MATIC RELATIONSHIPS, New South Wales State Fisheries, Sydney (Aus-

tralia). D. A. Pollard.

Aust J Mar Freshwater Res. Vol 22, No 2, p 125-137. 1971. Illus.

Following a brief outline of the systematic relationships of a number of species comprising the G. maculatus species complex, the morphology of the 'landlocked jollytail,' a lacustrine galaxiid from Lake Modewarre (south-western Victoria), is Lake Modewarre (south-western Victoria), is described and compared with that of the normally catadromous stream-dwelling species G. maculatus and a number of other closely related forms belonging to this complex. The probable systematic status of the landlocked jollytail and its relationship to the other forms included in the G. maculatus species complex are then discussed in the light of both the above morphological evidence, and ecological and behavioral evidence from a previous study of the life cycle and discus-sion of the probable origin of this lacustrine form. son of the processe origin of this accustme torm. The landlocked jollytail should probably be regarded as no more than an isolated 'ecological race' of the normally catadromous stream-dwelling species, G. maculatus. (See also W73-02855)—Copyright 1972, Biological Abstracts, Inc. W73-02856

FLOOD PLAIN VEGETATION OF THE MID-FLOOD PLAIN VEGETATION OF THE MID-DLE REGIONS OF THE KERULEN RIVER (FROM INFORMATION OF THE JOINT SOVIET-MONGOLIAN COMPLEX BIOLOGI-CAL EXPEDITION OF THE ACADEMY OF SCIENCE OF THE USSR AND THE ACADEMY OF SCIENCE OF THE MP R, (IN RUSSIAN), R. S. Kashapov, S. V. Maksimovich, B. M. Mirkin, V. S. Mukhametshina, and K. Tulgaa. Bot Zh. Vol 56, No 12, p 1740-1758. 1971. Illus. En-glish summary.

glish summary.
Identifiers: Aquatic plants, Biological expedition,
Bogs, *Floodplains, *Kerulen River, Meadows,
*Mesophilic bushes, Mongolian, Rivers, Shrubs,
Steppe, USSR, *Vegetation.

The most common associations of mesophilic bushes, meadows, coastal-aquatic, bog and steppe vegetation of the floodplain are considered. Regu-larities of vegetational change along the longitu-dinal profile of the river valley were revealed.— Copyright 1972, Biological Abstracts, Inc. W73-02882.

RADIAL OXYGEN LOSSES FROM INTACT RADIAL UNIGEN LOSSES FROM INTACE RICE ROOTS AS AFFECTED BY DISTANCE FROM THE APEX, RESPIRATION AND WATERLOGGING, Hull Univ. (England). Dept. of Botany. For primary bibliographic entry see Field 03F. W73-02930

SODIUM EXPORT FROM BEAN LEAVES AS AFFECTED BY THE MODE OF APPLICATION, Hebrew Univ., Rehovoth (Israel). Dept. of Agricultural Botany.

B. Jacoby, and O. E. Plessner.

Israel Journal of Botany, Vol 20, No 4, p 311-317, 1071, 1284, 4fg. 12-327.

1971. 1 tab, 4 fig, 12 ref.

Descriptors: *Exudation, *Plant physiology, *Beans, *Absorption, *Ion transport, *Sodium, Mode of action, Drops (Fluids), Osmotic pressure, Plant growth substances, Translocation, Metabolism, Movement, Ions, Vegetable crops, Growth

Sodium ions are rapidly accumulated by tissue slices from expanding bean leaves, as well as by bean roots and stems. However, recent work inbean roots and stems. However, recent work indicates a very low sodium retention capacity of in situ expanding bean leaves. This work shows that sodium export from bean leaves is greatly affected by the mode of its application. No 22Na export occurred from primary leaves on eight-day-old plants when it was applied by leaf-vein injection; in contrast, a considerable amount was exported when 22Na was applied as a droplet. A much larger potion of absorbed sodium was exported from the leaves of 10-day old plants when applied as a droplet than when introduced by the leaf-vein. (Black-Arizona) W73-03073 W73-03073

SALT INJURY TO PLANTS WITH SPECIAL REFERENCE TO CATIONS VERSUS ANIONS

AND ION ACTIVITIES, California Univ., Riverside. Dept. of Soil Science. For primary bibliographic entry see Field 03C. W73-03077

ENVIRONMENTAL INFLUENCE ON THE PAT-TERN OF PLANT COMMUNITIES ALONG THE NORTH RIM OF THE GRAND CANYON, Illinois Univ., Urbana. Dept. of Botany.

W. L. Halvorson.
The American Midland Naturalist, Vol 87, No 1, p 222-235, 1972. 5 tab, 2 fig, 21 ref.

Descriptors: *Environmental effects, Biological communities, Ecological distribution, Environmental gradient, *Pinyon pine trees, *Ponderosa pine trees, *Sagebrush, Ecotypes, *Distribution patterns, *Boundary processes, Convection, Limiting factors, Microedinavironment, Arizona, Microelimatology, Ecology, Air circulation, Southwest U.S., Thermal stratification. Identifiers. *Grand Canyon, Kaipha Plateau. Identifiers: *Grand Canyon, Kaibab Plateau.

The bottom of the Grand Canyon, in northern Arizona, is always warmer during the day than the rim (reaching 50 degrees C in the summer) and this rm (reaching 30 degrees C in the summer) and this results in strong convective currents. Hot winds which blow out of the Canyon not only have the immediate effect of drying and heating the areas adjacent to the rim, but also tend to affect the storms which come into the region. It is common to see storms lose little water near the rim and increase in precipitation as they move northward

away from the rim. The pattern of vegetational away from the rim. The pattern of vegetational communities along the north rim is described. Microenvironmental studies showed that pinyon pine (Pinus edulis) occurred only as a thin band along the rim due to climatic conditions created by the Canyon. In drier sites behind the band of pinyon pine, sagebrush (Artemisia tridentata) communities develop. The communities are common below the Kaibab Plateau (1500-1800 m), but the contraction of the communities are composed exercised to crease in clean exercise. rare and restricted to areas in close proximity to the Canyon at elevations of 2300-2400 m. Ponderosa pine (Pinus ponderosa) forests develope a only N of the pinyon pine forest and sagebrush desert where moisture and other microenvironmental conditions were favorable. Evidence is which occurs which occurs which occurs presented to show that this change, which occurs in a very short distance, is due to the effects of the Grand Canyon and not to change in elevation which is typical for the Rocky Mountain areas. (Black-Arizona) W73-03078

REHYDRATION OF PHYTOCHROME IN IM-BIBING SEEDS RETROFLEXUS L., AMARANTHUS OF

Agricultural Research Service, Beltsville, Md. Plant Science Research Div.
R. B. Taylorson, and S. B. Hendricks.
Plant Physiology, Vol 49, No 4, p 663-665, 1972. 3

Descriptors: *Germination, Limiting factors, *Hydration, *Light intensity, *Photoactivation, *Photosynthesis, Biochemistry, Bioassay, Photoperiodism, Plant physiology, Plant growth substances, Plant growth regulators, Light penetration, Phenology, Soaking, Seeds. Identifiers: *Imbibition, Phytochrome.

It is commonly recognized that light-sensitive seeds require a period of imbibition before full seeds require a period of imbibition before full promotion of germaination by a light stimulus can be attained. Rehydration of inactive phytochrome seeds (as determined by a method by which phytochrome rehydration can be physiologically separated from other events occurring during dark imbibition) is described. Duplicate lots of 100 seeds sown on moist filter naper in Petri disco impipition) is described. Duplicate lots of 100 seeds, sown on moist filter paper in Petri dishes, were used for each experimental treatment. After planting, the dishes were immediately enclosed in opaque, black cloth bags and placed in cabinets maintained at a specific temperature. Each treatment was repeated at least four times. At the conduction of the corrections of the conduction of the correction of clusion of the experimental treatments, germina-tion was achieved by incubation at 35 degrees C for 3 days using red and far red irradiations. Earlier data showing that rehydration (of active and in-active forms of phytochrome) can be detected physiologically during prechilling are supported and extended. (Black-Arizona)

NUTRIENT STATUS AND MYCORRHIZAL ENHANCEMENT OF WATER TRANSPORT IN

Illianis Univ., Urbana. Dept. of Plant Pathology. For primary bibliographic entry see Field 03F. W73-03087

WHICH WATER POTENTIAL, DIFFERENCES BETWEEN ISOPIESTIC THERMOCOUPLE PSYCHROMETER MEASUREMENTS OF IN-TACT AND EXCISED PLANT MATERIALS, Hohenheim Univ., Stuttgart-Hohenheim (West Germany). Botanisches Institut und Botanischer

For primary bibliographic entry see Field 07B. W73-03096

SEED PELLETING IN RELATION TO NODU-LATION AND NITROGEN FIXATION BY PHASE SOIL, Indian Div. of I For print W73-030

EFFECT ACRICI (India). Research For prim W73-031

RESPON PLANTS Arizona For prim W73-031

ASPECT (SOLAN) Arizona Lab H. M. Eis Journal o Science, tab, 13 re

Descripto dies, Phy ticulture, Metaboli ing, Gro The occi

oedema in greenhou are report 6 cultivar young an followed characteri apparently mal cells, susceptibl correl from one ditions les warm moi humidity. W73-0310

AN EFF Texas A a For primar W73-03112

EVIDENC OF THE Tel Aviv U I. Ilan. Physiologi 1971. 3 tab

Descriptor growth sub Movement Plant phys port.

PHASEOLUS AUREUS L. IN A SALINE ALKALI

SOIL, Isdian Agricultural Research Inst., New Delhi. Div. of Microbiology. For primary bibliographic entry see Field 03C. W73-03097

EFFECT OF LATERAL DEVELOPMENT OF PROSOPIS JULIFLORA DC. ROOTS ON AGRICULTURAL CROPS, Indian Council of Agricultural Research, Bellary (India). Southern Regional Soil Conservation Research Sub-Station.

For primary bibliographic entry see Field 03F. W73-03101

RESPONSE OF OSMOTICALLY STRESSED PLANTS TO GROWTH REGULATIONS, Arizona Univ., Tucson. Environmental Research

Lab. For primary bibliographic entry see Field 03C. W73-03104

MORPHOLOGICAL AND ANATOMICAL ASPECTS OF OEDEMA IN EGGPLANTS (SOLANUM MELONGENA L.), Arizona Univ., Tucson. Environmental Research

Lab. H. M. Eisa, and A. K. Dobrenz.

Journal of the American Society for Horticultural Science, Vol 96, No 6, p 766-769, 1971. 12 fig, 3 tab. 13 ref.

Descriptors: *Plant morphology, Plant physiology, *Plant diseases, *Plant tissues, Cytological studies, Physiological ecology, Vegetable crops, Horticulture, Greenhouses, Crop production, Metabolism, Agronomy, Resistance, Plant breeding, Growth chambers, Environmental effects, *Mexico. Identifiers: *Sonora (Mexico), *Oedema.

The occurrence, morphology, and anatomy of oedema in eggplants grown in air-supported plastic greenhouses in Puerto Penasco, Sonora, Mexico are reported. Oedema in eggplant occurred in 2 of 6 cultivars, and was limited to the upper side of young and old leaves, including the petioles. Anatomically, hypertrophy of the palisade cells, followed by rupturing in the epidermis, was characteristic of oedemata. Hypertrophied cells apparently contained fewer chloroplasts than normal cells, although chlorophyll delermination for susceptible and resistant cultivars did not suggest a correlation with this oedema. Although morphological and anatomical expression differed from one crop to the other, the environmental conmorphological and anatomical expression differed from one crop to the other, the environmental con-ditions leading to its occurrence are the same, i.e., warm moist soil and cool nights with high relative humidity. (Black-Arizona) W73-03105

AN EFFECT OF WATER STRESS ON ETHYLENE PRODUCTION BY INTACT COT-

TON PETIOLES,
Texas A and M Univ., College Station. Dept. of

For primary bibliographic entry see Field 03F. W73-03112

EVIDENCE FOR HORMONAL REGULATION OF THE SELECTIVITY OF ION UPTAKE BY PLANT CELLS, Tel Aviv Univ. (Israel). Dept. of Botany.

I. Ilan. Physiologia Plantarum, Vol 25, No 2, p 230-233, 1971. 3 tab, 10 fig.

Descriptors: "Metabolism, "Absorption, "Plant growth substances, "Selectivity, Moisture uptake, Movement, Translocation, Osmosis, Inhibitors, Plant physiology, Cytological studies, "Ion transport.

Kinetin exerted opposing effects on the uptake of K+ and Na+ ions by leaf discs of Helainthus annuus such that the absorption of K+ was stimulated and that of Na+ was inhibited. The K+/Na+ ratio in kinetin-treated discs was 80 - 100 percent higher than in control tissue. Kinetin also moted K+ uptake by the detached cotyledons which had been removed from light-grown seedlings. On the other hand, no clear effect on the absorption of Na+ by these cotyledons could be established. It is concluded that cytokinins bring about a change in the selectivity of the cells of sunflower leaves and cotyledons towards K+ and Na+, such that the 'affinity' of the cells for potassium is increased, as compared to the 'affinity' for sodium. The possible significance of such a change in selectivity is discussed. (Black-Arizona) W73-03113

PATTERNS OF WATER UPTAKE AND ROOT DISTRIBUTION OF SOYBEANS (GLYCINE MAX.) IN THE PRESENCE OF A WATER TA-BLE,

Agricultural Research Service, Urbana, Ill. Soil and Water Conservation Research Div. For primary bibliographic entry see Field 03F. W73-03114

ECO-PHYSIOLOGICAL STUDIES ON DESERT PLANTS. III. RESPIRATION OF NEGATIVELY PHOTOBLASTIC ZYGOPHYLLUM COCCINE-UM L. SEEDS DURING GERMINATION.

Technische Universitaet, Munich (West Germany). Botanisches Institut. K. H. Batanouny, and H. Ziegler. Oecologia, Vol 8, No 1, p 64-77, 1971. 6 fig, 3 tab,

12 ref.

Descriptors: *Respiration, *Oxygen requirements, Physiological ecology, *Germination, Environmental effects, Plant physiology, *Sed treatment, *Soaking, Wetting, Laboratory tests, Desert plants, Photoperiodism, Light, Moisture tension, Plant growth, *Seeds.

Identifiers: *Zygophyllum coccineum seeds.

A previous study established that Zygophyllum a previous study established that Ergophynum coccineum seeds are negatively photoblastic. It also appeared that seeds could germinate in dark up to 55 percent under a moisture stress of 16 atm in mannitol solution in NaCl solution with an osmotic value of 8 atm, and in Na2SO4 solution with an osmotic value of 6 atm. Light, moisture stress, salinity actions, and the influence of these factors on respiration during the early stages of germination were studied. Seeds were soaked in germination were studied. Seeds were soaked in water under dark and light conditions. The respira-tion course in light did not differ from that in dark until the 12th hour after soaking, then it deviated showing a low level. Light, by blocking germina-tion, affected the O2 uptake. Moisture stress simu-lated by mannitol solutions caused a decrease in the O2 uptake of seeds, as did Na2SO4. NaCl showed a particular effect on respiration of gersnowed a particular creek on respiration ago-minating seeds causing earlier rise and decrease in O2 uptake than in water. O2 uptake of seedlings germinated in NaCl was considerably high when compared with that of seeds germinating in the same medium 40 hours after soaking. (See also W73-00176) (Black-Arizona) W73-03116

MINERAL ION COMPOSITION OF HALOPHYTIC SPECIES FROM NORTHERN UTAH.

Utah State Univ., Logan. Dept. of Botany. H. H. Wiebe, and H. Walter. The American Midland Naturalist, Vol 87, No 1, p 241-245, 1972. 1 tab, 23 ref.

Descriptors: Plant morphology, Plant growth substances, Plant physiology, "Translocation, Cytological studies, "Inhibitors, "Salt tolerance, Soil-water-plant relationships, "Saline soils, Biochemistry, "Desert plants, "Halophytes, Plant

tissues, Deserts, *Utah, Great Salt Lake, Laboratory tests, Great basin, Saline lakes.

The dominant vegetation of the cold, salt deserts of northern Utah consists of species and genera of Chenopodiaceae. Although the soils underlying these communities have been studied extensively, there is little information on the mineral composi-tion of the plants themselves. Measurements were tion of the plants themselves. Measurements were made to study the cellular medium in which enzymes of halophytic species operate. Selected species growing along the shores of Great Salt Lake and the adjacent desert were analyzed for water-soluble sodium, potassium, calcium, magnesium, chloride, and sulphate ions. Several genera of Chenopodiaceae and the grass Distichlis spicata grow in the most saline habitats, whereas other chenopodia composite and grasses are dominant. chenopods, composites and grasses are dominant on less saline soils. Members of the Chenopodiaceae contained much higher sodium and chloride contents than did composites of grasses growing in the respective regions. NaCl grasses growing in the respective regions. NaCl content increased with increasing soil salinity. Water-soluble calcium was very low in all chenopods, possibly because of precipitation as oxalate, while grasses and composites had much higher calcium contents. (Black-Arizona) W73-03117.

EFFECTS OF WATER STRESS ON THE RE-SISTANCE TO UPTAKE OF CARBON DIOXIDE IN TOBACCO, Stirling Univ. (Scotland). Dept. of Industrial

For primary bibliographic entry see Field 03F. W73-03193 Science.

THE USE OF A MULTI-CELLED APPARATUS FOR ANAEROBIC STUDIES OF FLOODED ROOT SYSTEMS,

Agricultural Research and Educational Center. Lake Alfred, Fla.

Lake Alfred, Fla.
D. L. Culbert, and H. W. Ford.
Hortscience. Vol 7, No 1, p 29-31, 1972. Illus.
Identifiers: "Anaerobic conditions, Apparatus,
"Lemon-D, Oxygen deficiency, "Root systems,

A circulating system with sufficient versatility to permit monitoring and control of solutions in the flooded root rhizosphere is described. The system flooded root rhizosphere is described. The system circulates anaerobic solutions around plant roots or can be used to simulate the type of flooded environment necessary for anaerobic bacterial activity. The composition of the solution can be monitored before, during, and after contact with the roots. O2 deficiency per se was relatively harmless to citrus roots, whereas severe root damage occurred from exposure to less than 3 ppm total sulfides at pH 6 for 7 days. Tolerance to flooding of rough lemon appears to be associated with tolerance to injury by H2S.—Convright 1972. with tolerance to injury by H2S.—Copyright 1972, Biological Abstracts, Inc.

AN ECOLOGICAL STUDY OF THE SOIL MICROFUNGI IN A HAWAIIAN MANGROVE

Hawaii Univ., Honolulu. Dept. of Botany. K. H. Lee, and G. E. Baker. Pac Sci, Vol 26, No 1, p 1-10, 1972, Map. Identifiers: "Mangrove swamps, Bruguiera sexan-gula D, Ecology, "Fungi, "Hawaii, Hibiscus tiliae D, Hydrogen, Rhizophora mangle D, Salinity, Soils, Sulfides.

Two true mangroves--Rhizophora mangle L. and Bruguiera sexangula Lour-and 1 fresh-water man-grove--Hibiscus tileaceus L.-are the dominants. hey show a distribution in 3 zones from seaward to inland areas depending on salinity level. The same zonal distribution of salinity controlled the distribution of the soil microfungi. The microfungi, represented by 52 spp., were identified as 47

Group 21-Water in Plants

Fungi Imperfecti, 4 Ascomycetes and 1 Phycomycete. Numbers by zonal occurrence were practically equivalent from seaward to inland sites, but only 11 spp. were common to the 3 zones. Each zone had its own community of microfungi. A similar independence of communities is known for microfungi in mangrove swamp soils of East Africa and India. Controlling environmental facmicrofungi tors-salinity level, waterlogged soil and the presence of H2S-are common to these 3 widely separated geographic areas.-Copyright 1972, Biological Abstracts, Inc. W73-03205

EARLY GROWTH AND DEVELOPMENT OF SLASH PINE UNDER DROUGHT AND FLOOD-

Forest Service (USDA), Athens, Ga. Forestry Sciences Lab.
For primary bibliographic entry see Field 04A. W73-03207

2J. Erosion and Sedimentation

CONTROL OF MERCURY POLLUTION IN Robert S. Kerr Water Research Center, Ada, For primary bibliographic entry see Field 05G. W73-02632

MECHANISM OF THE FORMATION OF SOME 'TERMINAL MORAINES' AND ROLE OF WATER IN GLACIAL EROSION (MEKHANIZM WATER IN GLACIAL EROSION (MEKHANIZM
OBRAZOVANIYA

'KONECHNYKH MOREN' I ROL' VODNOY
EROZII V DINAMIKE LEDNIKA),
Akademiya Nauk Kirgizakoi SSR, Frunze.
Tyanshanskaya Vysokogornaya FizikoGeograficheskaya Stantsiya.
For primary bibliographic entry see Field 02C.
W73-02642

DISPERSION OF CONTAMINATED BED-LOAD

Colorado State Univ., Fort Collins. Dept. of Civil For primary bibliographic entry see Field 05B. W73-02650

SYNOPTIC MEASUREMENTS OF CURRENTS AND SEDIMENT TRANSPORT ON THE CON-TINENTAL SHELF, ANNUAL PROGRESS RE-

PORT, Washington Univ., Seattle. For primary bibliographic entry see Field 02L. W73-02716

URANIUM CONCENTRATION IN RECENT OCEAN SEDIMENTS IN ZONES OF RISING

CURRENTS,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii. mary bibliographic entry see Field 05B. W73-02748

ORIGIN OF MANGANESE NODULES OF THE PACIFIC OCEAN FROM RADIOISOTOPE

Akademiya Nauk SSSR, Moscow. Geologicheskii Institut. For primary bibliographic entry see Field 05B.

W73-02752

TEMPERATURE EFFECTS IN HIGH-TRAN-REMITERATURE EFFECTS IN HIGH-TRAN-SPORT, FLAT-BED FLOWS, California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, Paper 9456, p 2191-2206, December 1972. 11 fig, 2 tab, 8 ref, append. NSF Grant GK3910.

Descriptors: *Bed load, *Sediment transport, *Water temperature, *Boundary processes, Reynolds number, Hydraulic models, Shear drag, Open channel flow, Alluvial channels, Suspended load, Sedimentation, Sedimentology, Sediment

Flume experiments show that in flows over flat beds of fine sand, the concentration of suspended load near the bed and the bed-load discharge of different size fractions of the bed sediment react differently to a change in water temperature. For differently to a change in water temperature. For example, an increase in water temperature alone caused the concentration near the bed and the bed-load discharge to increase for the finer fractions of the sediment and to decrease for the coarser fractions. The reaction of bed-load dishcarge of sediment of a given size to changes in water temperature can be expressed in terms of the boundary Reynolds number, R*b, which is formed of the product of shear velocity and sediment diameter divided by the kinematic viscosity of the water. An increase in temperature will cause an increase in bed-load dishcarge of a particular size fraction when R*b based on the mean size of the fraction is less than 13, and a decrease in bed-load discharge less than 13, and a decrease in bed-load discharge when R*b exceeds 20. (Knapp-USGS) W73-02789

URBAN SEDIMENTATION-IN PERSPECTIVE,

UNDAY SEDIMENTATION—IN PERSPECTIVE, Geological Survey, Reston, Va. H. P. Guy, and D. E. Jones, Jr. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, Paper 9420, p 2099-2116, December 1972. 1 fig, 1 tab. 49 ref.

Descriptors: *Sediment control, *Urban hydrology, *Cost-benefit analysis, *Reviews, *Sediment gy, *Cost-benefit analysis, *Reviews, *Sedimens yield, Land use, Urban runoff, Erosion, Urban drainage, Urbanization, Urban sociology, Research and development, Suburban areas. Identifiers: *Urban sedimentation.

Optimum and effective sedimentation controls in urban construction areas require a balanced per-spective of costs and benefits. The costs which must be added to the price of the finished product, must be balanced against the benefits to inmust be balanced against the benefits to in-dividuals and society, mostly as reduction in en-vironmental impact. To acquire this perspective, better understanding is needed in regard to: (1) physical aspects of sediment erosion, its transport in streams, and the nature of its deposition in urban areas; (2) alternatives for land use; (3) the cost of sediment impact on streams and other water bodies; and (4) the cost and effectiveness of sediment control measures. The conclusion is that sediment control measures. The conclusion is that a substantial research and educational effort is needed to obtain and disseminate the required knowledge. It is not sufficient to simply transpose technology used for sediment control in the rural areas to the urban areas. (Knapp-USGS) W73-02793

SEDIMENT YIELD COMPUTED WITH UNIVERSAL EQUATION, Agricultural Research Service, Riesel, Tex- Soil and Water Research Div.
J. R. Williams, and H. D. Berndt.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, Paper 9426, p 2087-2098, December 1972. 3 fig, 3 tab, 8 ref, append.

Descriptors: *Sediment yield, *Soil erosion, *Mathematical models, Equations, Sedimentation, Grassed waterways, Erosion control, Reservoir silting, Sediment discharge, Vegetation effects, Watershed management.

Sediment yield from watersheds may be predicted by modifying the Universal Soil Loss Equation and using a delivery ratio. All factors of the equation except the rainfall factor were modified to increase computational efficiency. In addition, the crease computational efficiency. In addition, the erosion-control-practice factor was expanded to include the separate effect of grassed waterways. Delivery ratios were computed for five small blackland watersheds and related to watershed characteristics. Step-wise multiple regression was used to develop equations for predicting delivery ratios. The regression analysis showed that slope of the main stem channel explains about 99% of the variation. The modified Universal Soil Loss Equation and the equation for redicting delivery. Equation and the equation for predicting delivery ratios form a sediment yield model that should be useful in reservoir design and water quality studies. (Knapp-USGS) W73-02794

PREDICTING SEDIMENT YIELD IN WESTERN

UNITED STATES, Soil Conservation Service, Portland, Oreg. En-gineering and Watershed Planning Unit.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, Paper 9432, p 2073-2085, December 1972. 1 fig. 2 tab, 5 ref.

Descriptors: *Sediment yield, *Erosion, *Equa-tions, *Sheet erosion, Statistics, Statistical methods, Regression analysis, Sedimentation, Land use, Climates, Soil erosion, Vegetation ef-fects, Soil physical properties. Identifiers: Western U.S.

An equation for predicting the average annual nent yield from sheet erosion was develo through multiple-regression analysis. Most of the variation in yield is explained with data obtained by measurement of four watershed characteristics. A climatic factor as indirect expression of vegeta-tive cover), the average watershed slope, and two soil factors are the variables used. A good correlation of computed with measured sediment yields is obtained except at the lower rates of sedimenta-tion. Improvements in predictive values can be achieved with experience in judging the necessary adjustments in the vegetative cover factor, through soil sampling, and by use of longtime sedi-ment yields. The data selected for this analysis ex-clude the influence of extensive gully or stream bank erosion. (Knapp-USGS) W73-02795

LATE-STAGE MEANDER GROWTH, University Coll. of Wales, Aberystwyth. Dept. of

Geography. J. Lewin.

Nature Physical Science, Vol 240, No 101, p 116, December 4, 1972. 1 fig. 8 ref.

Descriptors: *Meanders, *Channel erosion, Scour, Rivers, Mapping, Alluvial channels, Geomorphology, Bream erosion, Channel er

Meanders, bars and riffles were manned on the River Rheidol, Wales, at Lovesgrove in 1951 and 1971. The low-flow channel is irregular in width and dependent on bedform at all but the highest flows, but approximately even spacing of riffles is maintained, despite growth of one meander loop and the artificial cutoff and redevelopment of and the artificial cutoff and redevelopment of another. On the Rheidol, three pools occur on the 1971 westerly meander loop, and the single loop is beginning to subdivide. In fact, the channel had al-ready done so to a greater extent, but was artifi-cially reconstructed to a single curve of trape-zoidal cross-section, which it once more started to distort. The process is continuing. (Knapp-USOS) W73.07362. PALAE GLOBIC FROM 7 National tion, M Meteoro R. H. Be Nature I 115, Dec

Descript ments, sion, M Sampling Identifie

Oxygen

measurin matic tre Earth hi submarin engineer mass ph from the not a di rather is i carbonate ture. Rela cores sug variations sion corr paleotem W73-0279

TION, SACLAN (Italy). T. Akal. Marine (Novembe Descriptor perties, Si Porosity,

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The relati sediments died by us taken from Pacific an Mediterra sional sou the cores (fluid-fluid are discuss porosity. can be rela tion, and re polynomia mate of ti USGS) W73-02798

SLUMPING THE ROC OCEAN, National I gland). D. G. Robe Marine G November

Descriptors
*Mudflows Slopes, To Stratigraph Identifiers: PALAEOTEMPERATURE AND COHESION IN

PALAROTEMPERATURE AND COHESION IN GLOBIGERINA OOZE SEDIMENT CORES FROM THE CARIBBEAN SEA, National Oceanic and Atmospheric Administration, Mismir Fla. Atlantic Oceanographic and Meteorological Labs. R. H. Bennett. Nature Physical Science, Vol 240, No 101, p 114-115, December 4, 1972. 2 fig, 15 ref.

Descriptors: *Paleoclimatology, *Bottom sediments, *Water temperature, *Particle size, *Cohesion, Marine microorganisms, Mud, Cores, Sampling, Sedimentology.
Identifiers: *Caribbean, Globigerina ooze.

Oxygen isotope research provides a means for measuring temperatures of ancient seas, substan-tially increasing understanding of the broad cli-matic trends over the past several million years of matic trends over the past several minion years of Earth history. Shear strength measurements of submarine sediments give the marine geologist and engineer a clearer understanding of some of the mass physical properties of these sedimentary deposits. Two sediment cores of Globigerina ooze from the Caribbean were analyzed. Cohesion is not a direct function of paleotemperature but rather is influenced significantly by the size of the carbonate tests which are responsive to tempera-ture. Relative values of cohesion throughout the cores suggest a strong relationship to variation in texture and a correlation with paleotemperature variations. In general, high and low values of cohesion correspond to warm and cold periods of paleotemperature, respectively. (Knapp-USGS) W73-02797

THE RELATIONSHIP BETWEEN THE PHYSI-CAL PROPERTIES OF UNDERWATER SEDI-MENTS THAT AFFECT BOTTOM REFLEC-TION.

SACLANT ASW Research Centre, La Spezia (Italy). T. Akal.

Marine Geology, Vol 13, No 4, p 251-266, November 1972. 13 fig, 34 ref.

Descriptors: *Bottom sediments, *Seismic properties, "Sounding, "Seismic studies, "Physical pro-perties, Stratification, Stratigraphy, Calibrations, Porosity, Geophysics, Sonar.

The relationship between physical properties of sediments that affect bottom reflection were studied by using the data from more than 400 cores taken from various physiographic regions of the Pacific and Atlantic Oceans and the Norwegian, Mediterranean, and Black Seas. The compressional sound velocities and densities measured in stonal sound velocities and definition included in the cores and the Rayleigh reflection coefficients (fluid-fluid interface) computed from these values are discussed with respect to their dependence on porosity. The density and reflection coefficients can be related to porosity by a simple linear equa-tion, and relative sound velocity by a second-order polynomial equation. The standard errors of esti-mate of these relationships are given. (Knapp-USGS) W73-02798

SLUMPING ON THE EASTERN MARGIN OF THE ROCKALL BANK, NORTH ATLANTIC OCEAN

National Inst. of Oceanography, Wormley (En-D. G. Roberts.

Marine Geology, Vol 13, No 4, p 225-237, November 1972. 6 fig, 2 tab, 30 ref.

Descriptors: *Bottom sediments, *Mass wasting, *Mudflows, *Landslides, *Atlantic Ocean, Slopes, Topography, Sounding, Seismic studies, Stratigraphy, Geomorphology.

Identifiers: *Rockall Bank (Atlantic Ocean),

Two large slumps were found in the upper slopes of the eastern margin of the Rockall Plateau by using topographic and seismic profiler data. The upper of the two slumps can be traced for 160 km and has an average width of 14 km. The slumps and has an average width of 14 km. I ne sumps may be as young as Pleistocene in age. They are developed in a slope of 2 deg. Their origin is not clear; they may have developed as a consequence of lower sea level during the Pleistocene although they may also be indirectly related to the subsidence of the Rockall Plateau. (Knapp-USGS)

BED-LOAD TRANSPORT IN MOUNTAIN STREAMS, Oregon State Univ., Corvallis, Dept. of Civil En-

gineering.
R. T. Milhous, and P. C. Klingeman.
Paper presented at 1971 Hydraulics Division Specialty Conference, American Society of Civil Engineers, University of Iowa, August 18-20, 1971.
30 p, 14 fig, 4 tab, 2 ref. OWRR A-001-ORE (8).

Descriptors: Gravels, Streambeds, *Sediment transport, Water quality, *Bed load, *Oregon, Watersheds (Basins). Identifiers: *Oregon coastal range, *Oak Creek (Ore)

Bedload transport is a coarse-bedded mountain stream draining a forested watershed in the Oregon Coastal Range has been measured for two years using a vortex bedload sampler capable of extracting the entire bedload of the stream. Characteristics of such bedload transport are described in terms of streamflow and hydraulic parameters. Comparisons are made of observed bedload transport under transient (storm runoff) conditions and transport rates based upon bedload equations derived for equilibrium conditions. The importance of streambed armouring is discussed with particular emphasis on the effects of such armor layers upon observed bed-load transport rates. The fraction of total sediment transport which is moved as bedload is shown to increase significantly with water discharge. W73-02893

EROSIONAL CONSEQUENCES OF TIMBER

HARVESTING: AN APPRAISAL, Forest Service (USDA), Glendora, Calif. Pacific Southwest Forest and Range Experiment Station. R. M. Rice, J. S. Rothacher, and W. F. Megahan. In: Proceedings, National Symposium on Watersheds in Transition, American Water Resources Association, 1972. p 321-329. 3 tab, 59

Descriptors: *Lumbering, *Accelerated erosion, *Access routes, *Landslides, Clearcutting, Forest management, Forest fire, Erosion control, Mass wasting, Rill erosion, Gully erosion, Roads, Slope stability.

Identifiers: *Dry ravel, *Watershed disturbance, Slash burning.

Timber harvesting is the most important human activity affecting the condition and performance of forested watersheds. Erosion in an undisturbed forest usually represents a minimum for the site. Consequently, increased erosion is an almost cer-tain by-product of logging. While erosion rates in mountainous forested watersheds are highly variable, there is consistency in the relative importance of different types of erosion and the consequences of the various disturbances. Landslides and creep are the principal forms of natural erosion in mounare the principal forms of natural erosion in moun-tainous regions under a wide variety of climates and site conditions. Erosion rarely occurs uniformly in a forest watershed. Usually erosion features are deep and include a large portion of subsoil and weathered parent material. Normally, bared areas are quickly invaded by pioneer species and initially high rates of sediment production decline rapidly. Due to the tendency for sediment

to come mainly from localized unstable areas, land to cohe many item to accurate a stratification can be used to reduce the erosional consequences of human activities. Usually, the cutting of trees by itself does not significantly increase erosion. However, clearcutting on steep unstable slopes may lead to increased mass erosion. The road system developed for the timber harvest far overshadows other activities as a cause of accelerated erosion. Since the potential for accelerated erosion is so closely correlated with the road system the adoption of logging methods which require fewer roads can substantially reduce erosion resulting from timber harvest. W73-02957

METHODS FOR THE CHARACTERIZATION OF SUSPENDED SEDIMENT AND SELECTED APPLICATIONS FOR THE ACQUIRED DATA, Battelle-Pacific Northwest Labs., Richland Wash.

For primary bibliographic entry see Field 05B. W73-02977

NON-STEADY FLOW ON SLOPING BEACH WITH LARGE ROUGHNESS ELEMENTS, North Carolina State Univ., Raleigh. For primary bibliographic entry see Field 02E. W73-03040

VEGETATION, RUNOFF, AND SEDIMENT YIELD RELATIONSHIPS, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05B. W73-03067

THE USE OF ELECTRICAL RESISTIVITY TO DETERMINE POROSITY OF MARINE SEDI-

Rhode Island Univ., Kingston.

R. A. Erchul.

Available from National Technical Information Service as AD-740 792, \$3.00 in paper copy, \$0.95 in microfiche. Ph D Thesis, 1972. 242 p, 56 fig, 13 tab, 53 ref, 3 append.

Descriptors: *Sedimentology, *Oceans, *Bottom sediments, "Porosity, "Laboratory test, Model studies, Telemetry, Electrodes, Electrical re-sistance, Particle size, Correlation analysis, In-strumentation, Analytical techniques. Identifiers: *Ocean sediments.

Electrical resistivity measurements to determine the in situ porosity of marine sediments were investigated in the laboratory. Formation Factorporosity relationships were determined for three clays (kaolinite, illite, and montmorillonite). Providence silt, four sands, and four marine sediments. The porosity was predicted within plus or minus 2%. The Formation Factors ranged from 1.1 to 5.9 while porosity ranged from 26% to 93%. The particle size and distribution influenced the electrical resistivity of these sediments independent or porosity while particle shape did not. The Electri-cal Resistivity Measuring System designed for the Deep Ocean Sediment Probe consists of three interchangeable electrode arrays, the electronic circuit and the FM telemetry data link with 6000 feet of coaxial cable. The predicted porosity values obtained with the System in the laboratory were within plus or minus 2% of the line of best fit obtained with the earlier laboratory equipment. Using the inner core ring electrode array, the system was tested in the shallow water of Narragansett Bay, Rhode Island, and most of the data agreed well with the value obtained with the laboratory equipment on the same sediment. (Woodard-USGS) W73-03141

Group 2J-Erosion and Sedimentation

PEDIMENTS AND TERRACES ALONG THE MOAPA VALLEY, CLARK COUNTY, NEVADA, South Carolina Univ., Columbia, Dept. of Geolo-

gy. L. R. Gardner.

Geological Society of America Bulletin, Vol 83, No 11, p 3479-3486, November 1972. 3 fig, 12 ref.

Descriptors: *Geomorphology, *Erosion, *Topography, *Paleoclimatology, *Terraces (Geologic), *Nevada, Slopes, Land forming, Sediment transport, Running waters, Mass wasting, Alluvium, Alluvial channels. Identifiers: *Pediments, *Moapa Valley (Nevada). ming waters, Mass wasting, Alluvium,

A temporal-genetic model is proposed for the origin of pediments and terraces along the Moapa Valley, Clark County, Nevada. Pedimentation is a continuous process below the 1,000-m contour ar has been unaffected by transitions from pluvial to interpluvial periods, because climatic conditions below this elevation are constantly arid. Trunk drainage becomes incised during pluvial periods. During pluvial periods, pediment formation does not cause aggradation of the trunk drainage, because the main stream remains competent. During a long pluvial period, pedimentation may extend to the limits of the weak basin fill. This protects the trunk drainage against aggradation by local tributaries even during the subsequent interpluvial period, when the competence of the main stream is greatly reduced. Aggradation of the trunk drainage by local tributaries can occur during those interpluvial periods that follow short pluvial periods, because under these conditions there was little opportunity for the main stream to destroy the older, higher sources of sediment while its competence was high. (Knapp-USGS) W73-03146

2K. Chemical Processes

WATER FOR INDUSTRIAL DEVELOPMENT IN COPIAH AND SIMPSON COUNTIES, MISSIS-

Geological Survey, Jackson, Miss. For primary bibliographic entry see Field 03E. W73-02651

INSOLUBLE SPECIES AND POLYMERIZA-TION OF NITRATO COMPLEXES OF NITROSYLRUTHENIUM IN SEA WATER (NOUVELLES ETUDES SUR LES FORMES IN-SOLUBLES ET SUR LES PHENOMENES DE POLYMERISATION DES NITRATOCOM-PLEXES DU NITROSYLRUT HENIUM EN EAU DE MER),

Commissariat a l'Energie Atomique, La Hague (France).

For primary bibliographic entry see Field 05B. W73-02731

FEASIBILITY STUDY OF THE APPLICATION OF SOLVENT EXTRACTION AND GAS-LIQUID PARTITION PARTITION CHROMATOGRAPHY MARINE TRACE METAL ANALYSIS, Alaska Univ., College. Inst. of Marine Science. For primary bibliographic entry see Field 05A.

COLUMBIA RIVER EFFECTS IN THE NORTHEAST PACIFIC: CHEMICAL AND GEOLOGICAL STUDIES. PROGRESS REPORT, SEPT. 1971 TO MAY 1972.

Washington Univ., Seattle. Dept. of Oceanog-For primary bibliographic entry see Field 05B.

W73-02751

EVALUATION OF ION-EXCHANGE SURVEIL-LANCE SAMPLER FOR ANALYZING
RADIOACTIVE LIQUID EFFLUENTS,
Bureau of Radiological Health, Cincinnati, Ohio.
Radiological Engineering Lab.
For primary bibliographic entry see Field 05A.
W73-02753

TRACE-METAL ASSOCIATIONS IN SUB-A-RTIC AND ARCTIC MARINE ENVIRONMENTS
- PROGRESS REPORT, JUNE 1971-MAY 1972,
Alaska Univ., Fairbanks. Inst. of Marine Science. For primary bibliographic entry see Field 05B. W73-02754

REGIONAL HYDROGEOLOGIC INVESTIGA-TIONS IN KAZAKHSTAN (REGIONAL'NYYE V KAZAKHSTA Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-

stitut Gidrogeologii i Gidrofiziki. For primary bibliographic entry see Field 04B. W73-02809

MINERAL WATERS ALONG THE EASTERN MINERAL WATERS ALONG THE EASTERN
DOGE OF THE CASPIAN LOWLAND
(MINERAL'NYYE VODY VOSTOCHNOY
OKRAINY PRIKASPIYSKOY VPADINY),
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki.
For primary bibliographic entry see Field 04B. W73-02813

UNDERGROUND MINERAL WATER OF AL-PINE REGIONS OF SOUTHEASTERN KAZAKHSTAN (PODZEMNYVE MINERAL'-NYYE VODY VYSOKOGORNYKH RAYONOV YUGO-VOSTOCHNOGO KAZAKHSTANA), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-Stitut Gidrogeologii i Gidrofiziki.
For primary bibliographic entry see Field 04B.
W73-02818

TRANSFER PROPERTIES AND FRICTION COEFFICIENTS FOR SALT AND WATER FLOW THROUGH CLAYS, Hebrew Univ., Rehovoth (Israel). Dept. of Soil For primary bibliographic entry see Field 02G.

ISOPIESTIC DETERMINATION OF SOLUBILI-TIES IN MIXED SALT SOLUTIONS, TWO SALT

Department of Energy, Mines and Resources, Burlington (Ontario). Canada Center for Inland R F Platford

American Journal of Science, Vol 272, No 10, p 959-968, December 1972. 3 fig, 4 tab, 9 ref.

W73-02829

Descriptors: *Water analysis, *Saline water, *Sulfates, *Chlorides, *Vapor pressure, Sodium, Potassium, Chemical analysis, Saline water systems, Equipment, Water chemistry.

An isopiestic method was used to determine the compositions of solutions saturated in the systems H2O-K2SO4-Na2SO4 and H2O-NaCl-Na2SO4 at temperatures of 0 deg and 25 deg C. The concentrations were in agreement with published values, and the compositions of the solid phases reported in the literature were confirmed. The water activities of the solid phases present were determined. The method should provide a useful check on conventionally determined solubilities without the need for separation and analysis of the phases present and should give concentrations accurate to I weight percent or better. (Knapp-USGS) W73-03063 MAXIMUM CONCENTRATION OF DIS-SOLVED SOLIDS IN SURFACE WATER, HARTFORD NORTH QUADRANGLE, CON-

NECTICUT, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-03155

ENVIRONMENTAL G HEALTH AND DISEASE. GEOCHEMISTRY For primary bibliographic entry see Field 05B. W73-03196

DYNAMICS OF NUTRIENTS IN RELATION TO THE HYDROLOGICAL REGIME OF SOIL BOG FORESTS OF THE SOUTHERN TAIGA IN THE TRANSURALS (IN RUSSIAN), bibliographic entry see Field 02G. W73-03208

THE CONTENTS OF TRACE ELEMENTS IN ERODED SOD PODZOLIC SOILS FORMED ON MORAINIC DEPOSITS IN THE POOZER'E (LAKE AREA) OF BELORUSSIA (IN RUSSIAN), For primary bibliographic entry see Field 02G. W73-03214

2L. Estuaries

A GLOSSARY OF COASTAL ENGINEERING Army Enineer Div. South Pacific, San Francisco, Calif. Coastal Engineering Branch.
For primary bibliographic entry see Field 08B.
W73-02654

THE ROLE OF ZOOBENTHOS IN THE FEED-ING OF BOTTOM-FEEDING FISH AND THE FOOD SUPPLY AFTER THE DAMMING OF THE DON (IN RUSSIAN), Azovo-Chernomorskii Selskokhozyaistvennyi Institut, Rostov-na-Donu (USSR). M. Y. Nekrasova.

M. Y. Nekrasova.
Vopr Ikhtiol. Vol II, No 5, p 919-926. 1971. Illus.
Identifiers: Benthos, *Bottom-feeding fish, Don
River, Feeding habits (Fish), USSR, *Zoo
benthos, *Taganrog Bay (USSR), Dam construction.

The evaluation of food resources of the benthic fauna of the Taganrog Bay during damming of the Don river was studied. The production of zoobenthos, food coefficient and ratio figures for fish benthophage were determined.—Copyright 1972, Biological Abstracts, Inc. W73-02677

AUTUMN AND WINTER OCCURRENCE OF DECAPOD CRUSTACEANS IN CHESAPEAKE BIGHT, U.S.A., Virginia Inst. of Marine Science, Gloucester Point.

J. A. Musick, and J. D. McEachran. Crustaceana (Leiden). Vol 22, No 2, p 190-200.

Identifiers: Autumn, Cancer irroratus, *Chesapeake Bight, *Crustaceans, *Decapod crustaceans, Homarus americanus, Munida iris, Ovalipes ocellatus, Winter, Zoogeographical

Autumn and winter collections of decapod Autumn and winter concertons of decapool crustaceans in Chesapeake Bight suggest that the region may be divided into 3 zoogeographical zones: The Gulf Stream with its attendant tropical and southern fauna; the environmentally stable outer continental shelf and upper slope Cancer irroratus, Homarus americanus, and Munida iris are abundant; and the seasonally variable inner shelf which may support tropical or boreal species at certain seasons, but where the fauna is dominated by Virginian species such as C. irroratus Biologi W73-02

GROW FLUEN RENTS Duke U W. W. I J Exp N lus. Identific Bays, \
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WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Saline Water Conversion—Group 3A

roratus and Ovalipes ocellatus .-- Copyright 1972, Biological Abstracts, Inc. W73-02694

GROWTH OF THE BAY SCALLOP: THE IN-PLUENCE OF EXPERIMENTAL WATER CUR-

RENTS,
Duke Univ., Beaufort, N.C. Marine Lab.
W. W. Kirby-Smith.
J Exp Mar Biol Ecol. Vol 8, No 1, p 7-18. 1972. Il-

ins. Identifiers: Argopecten irradians concentricus, Bays, Water currents, Growth, Phytoplankton, *Scallops, *North Carolina, *Chlorophyll a, Aquaculture.

The growth of the bay scallop, Argopecten irradians concentricus (Say), from North Carolina was investigated in an experimental system which controlled the speed and volume of water flowing past 8 series of scallops. Under the influence of rapid current speed (12 cm/sec) the growth of the scal-lops almost ceased. Growth increased as the current speed decreased and at the slowest speed tested (0.21 cm/sec) reached the maximum observed. At this slowest speed, the low rate of water flow (10 ml/sec) gave a decrease in the growth of the scallops at the end of the series. It is calculated that the concentration of chlorophyll a in the outflow of the slowest current speed was reduced below 30% of the inflow as a result of the removal of suspended phytoplankton by the filter-ing activity of the scallops. Further calculations suggest that under the experimental conditions (27 deg. C; chlorophyll a±4.2 micro g/l) the growth of the scallops began to be reduced when the concentration of chlorophyll a dropped below 60% of the inflow and that growth ceased when the concen-tration dropped below 30%. These data are discussed with reference to the ecology of natural populations of bay scallops and with reference to some of the problems involved in the aquaculture of the species.—Copyright 1972, Biological Ab-stracts, Inc. W73-02702

NUCELLA LAPILLUS (L.) AS A PREDATOR OF EDIBLE COCKLES,

Hull Univ. (England). Dept. of Zoology.

P. R. Morgan.

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J Exp Mar Biol Ecol. Vol 8, No 1, p 45-52. 1972. Il-

lus. Identifiers: Cerastoderma edule, *Cockles, *Nu-cella lapillus, *Predator-prey relationship, Urosal-pinx cinerea, *Humber estuary (U.K).

Combined field and laboratory evidence suggests that most Cerastoderma edule L. taken by N. lapil-lus (L.) on 'Old Den,' an intertidal reef in the Humber estuary, are drilled, and that normally only I predator penetrates the shell. Other Nucella extent flesh from a penetrated cookle page its extract flesh from a penetrated cockle near its mantle margin. Cerastoderma is thinly scattered on the reef, and Nucella are attracted to them by an olfactory mechanism. Few individuals respond to material released from penetrated and damaged perior. The concept of 'ingestive conditioning' is discussed in relation to the observed variation in the responsiveness of Nucella. The behavior of Nucella is similar in many ways to that of Urosalpinx cinerea Say. The importance of prey scarcity and the conditions of the environment in determining the behavior of these gastropods is discussed.-Copyright 1972, Biological Abstracts, Inc. W73-02703

SYNOPTIC MEASUREMENTS OF CURRENTS AND SEDIMENT TRANSPORT ON THE CONTINENTAL SHELF. ANNUAL PROGRESS RE-

PORT, Washington Univ., Seattle.

R.W. Sternberg. Available from NTIS, Špringfield, Va., as RLO-2225-T-21-6; \$3.00 in paper copy, \$0.95 in

microfiche. Report RLO-2225-T21-6, April 1972. 7

Descriptors: *Washington, *Continental shelf, *Sediments, *Oceanography, Estuaries, Wind tides, Sedimentation, Sediment transport, Sedi-mentation rates, Dispersion.

Detailed reports (J. D. Smith and T. S. Hopkins, RLO-2225-T25-3, 1971; R. W. Sternberg and D. A. McManus, RLO-2225-T21-4, 1971; J. S. Creager and R. W. Sternberg, RLO-2225-T21-5, 1971) in-terpret current velocity measurements made over a 3-year period at a station 21 km offshore where the water depth was 80 m. Speeds great enough to move the silty sands found at the station occurred about 34% of the time, during winter storms. Presently, new instruments are collecting data at locations on the central continental shelf, and another instrument system is under construction.
(Bopp-ORNL)
W73-02716

UPTAKE OF RUI06 BY MARINE ORGANISMS IN AQUARIA AND IN THE NATURAL ENVIRONMENT (OBSERVATIONS CONCERNANT LES CONTAMINATIONS EXPERIMENTALES ET LES CONTAMINATIONS 'IN SITU' D'ESPECES MARINES PAR LE RUI06, Commissariat a l'Energie Atomique, La Hague

For primary bibliographic entry see Field 05B. W73-02717

RADIOACTIVE AND STABLE NUCLIDES IN THE COLUMBIA RIVER AND ADJACENT NORTHEAST PACIFIC OCEAN. Oregon State Univ., Corvallis. Dept. of Oceanog-

raphy. For primary bibliographic entry see Field 05B. W73-02745

COLUMBIA RIVER EFFECTS IN THE NORTHEAST PACIFIC: BIOLOGICAL STU-DIES. PROGRESS REPORT, JULY 1971-JUNE

Washington Univ., Seattle. Dept. of Oceanography. For primary bibliographic entry see Field 05B. W73-02750

COLUMBIA RIVER EFFECTS IN THE NORTHEAST PACIFIC: CHEMICAL AND GEOLOGICAL STUDIES. PROGRESS REPORT, SEPT. 1971 TO MAY 1972.

Washington Univ., Seattle. Dept. of Oceanog-

For primary bibliographic entry see Field 05B. W73-02751

TEMPERATURE SENSITIVITY OF TWO SPE-CIES OF INTERTIDAL FISHES, San Diego State Coll., Calif.

For primary bibliographic entry see Field 05C. W73-02762

MATHEMATICAL MODELS FOR REGIONAL ECONOMIC AND WASTE LOAD PROJEC-TION.

Environmental Protection Agency, New York. Data Systems Branch.
For primary bibliographic entry see Field 05B.

MULTI-DISCIPLINARY STUDY OF WATER QUALITY RELATIONSHIPS: A CASE STUDY OF YAQUINA BAY, OREGON, Oregon Agricultural Experiment Station, Corval-

For primary bibliographic entry see Field 05C.

AN ECONOMIC INVENTORY OF THE MIAMI RIVER AND ITS ECONOMIC AND ENVIRON-MENTAL ROLE IN BISCAYNE BAY, Miami Univ., Cora Gables, Fla. For primary bibliographic entry see Field 04A. W73-02923

AN APPROACH FOR INVOLVING LOCAL OF-FICIALS AND CITIZENS IN REGIONAL WATER QUALITY STUDIES, Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 05G. W73-02956

THE IMPACT OF WATER DEVELOPMENT ON THE ECOLOGY OF BAYS AND ESTUARIES, North Carolina State Univ., Raleigh. For primary bibliographic entry see Field 05B. W73-03069

FRAUNHOFER LINE-DEPTH SENSING AP-PLIED TO WATER,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05A.

EFFECTS OF AN ARTIFICIAL STREAM ON MARINE COMMUNITIES, Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume. For primary bibliographic entry see Field 05C. W73.04121. W73-03171

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DESALTING AS A SOURCE OF WATER

SUPPLY, Office of Saline Water, Washington, D.C. E. F. Miller.

Presented at American Water Works Association Annual Conference, Denver, Colorado, June, 16, 1971. 10 p, 3 tab.

Descriptors: *Desalination, *Desalination processes, *Water supply, *Brackish water, *Sea water, Reviews, Demineralization, Research and development, Water costs, Municipal water.

Since 1952, the Office of Saline Water has conducted research and development programs for saline water purification and demineralization. In saline water purification and demineralization. In 1958, Congress authorized the construction of five plants, 3 for sea water desalination and 2 for desalting inland brackish water. Significant amounts of feasibility and cost data were obtained in the years 1963-1967, although new methods are making rapid advancements in desalination processes. It has been found that desalination is too expensive and the economic advantages of importing water rather than desalting available water increase as the square of the demand. The study of the use of desalination techniques for brackish water sumplied is being accelerated and cost data the use of desalination techniques for brackish water supplied is being accelerated and cost data were computed for 14 cities. For total water treatment and water treatment waste disposal, the costs are from 50.90 to 51.05 per 1,000 gallons for a plant of 0.2 mgd to \$0.37-\$0.42 per 1,000 gallons for a plant of 11.1 mgd. Total costs above 10 mgd will range from 25 cents per 1,000 gallons to a low of 20 cents per 1,000 gallons. (Poertner) W73-02861

AN APPLICATION OF MULTI-VARIATE ANALYSIS IN HYDROLOGY, Colorado State Univ., Fort Collins. Environmental

Resources Center.
For primary bibliographic entry see Field 02E.

Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A-Saline Water Conversion

W73-02873

APPARATUS FOR THE DISTILLATION OF SEA WATER.

B. R. Step U.S. Patent No 3,619,380, 3 p, 2 fig, 10 ref; Official Gazette of the United State Patent Office, Vol 892, No 2, p 702, November 9, 1971.

Descriptors: *Patents, *Distillation, Sea water, Fresh water, *Flash distillation, *Desalination.

Sea water is pumped through both a first preheater heated by superheated steam and a condenser heated by combustion gases from a furnace to produce wet steam. The wet steam is then superheated by passage through the interior of a flame tube carrying the combustion gases away from the furnace. The wet steam is then sprayed against the exterior of the flame tube within an enclosed separator to flash the contained water so as to separate and release the salts and other impurities from the steam. (Sinha-OEIS) W71.02985

CENTRIFUGAL, MULTIEFFECT DISTILLA-TION APPARATUS, Compagnie Electro-Mecanique, Paris (France).

(assignee) R. Bidard.

U.S. Patent No 3,619,379, 4 p 9 ref; Official Gazette of the United States Patent Office, Vol 892, No 2, p 702, November 9, 1971.

Descriptors: *Patents, Sea water, *Distillation, Fresh water, *Evaporation, *Condensation, Water treatment, *Desalination.

A device is described for the distillation of sea water in several stages in which each has at least one cell through which the liquid flows and in which steam produced by evaporation is separated from the unevaporated liquid to obtain a condensate. Each cell consists of a heat exchanger and an outer U-shaped shell. A continuous inner wall as spaced from the outer leg of the shell to provide an expansion nozzle for the introduction of at least a portion of heated impure liquid from the heat exchanger. The expansion of the liquid causes partial evaporation in the nozzle. The apparatus comprises several cells operating at different temperatures. Steam produced by evaporation is condensed and drawn off and the remaining liquid passes into the system to be recycled. (Sinha-OEIS)

W73-02986

DESALTING AND PURIFYING WATER BY CONTINUOUS ION EXCHANGE, Gulf Degremont, Inc., Liberty Corner, N.J. (as-

Signee)
C. H. Thorborg.
U. S. Patent No. 3,617,554, 4 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 253, November 2, 1971.

Descriptors: *Patents, *Desalination, *Water purification, *Ion exchange, *Resins, *Cation exchange, Autor treatment, Sea water, Fresh water, Brackish water, *Industrial

Three units are provided in series, the raw water entering the first unit and the purified or fresh water leaving the third unit. As the water moves through the three units, an ion exchange resin flows in countercurrent to it. A weak base anion exchange resin in the bicarbonate state passes through the first unit and the same resin, in the free base form, passes through the third unit. A weak acid cation exchange resin passes through the second unit in countercurrent to the effluent. After passage through the first and second units the resins are regenerated. The third unit is a carbon dioxide degasifier. (Sinha-OEIS)

DESALINATION, Simon-Carves Ltd., Stockport (England), (as-

signee).
A. Martindale, B. R. Parr, and M. J. Smith.
U.S. Patent No 3,616,612, 5 p. 16 fig, 8 ref; Official Gazette of the United States Patent Office,
Vol 892, No 1, p. 46, November 2, 1971.

Descriptors: *Patents, *Desalination, water, Fresh water, Separation techniques, Equip-ment, Refrigeration, Water quality control. Identifiers: Refrigerants, Vaporization.

The apparatus for removing small quantities of refrigerant from saline water and fresh water consists of a container with a vertical partition to make separate flow paths. The partition has apertures to allow intermingling of the refrigerant vapor removed from the respective waters. A vacuum application device is arranged to feed from the compartment having the highest degree of vacuum into a compartment having a lower degree of vacuum. (Sinha-OEIS)

POROUS SUPPORT TUBES FOR REVERSE OS-

MOSIS, Westinghouse Electric Corp., Pittsburgh, Pa. (as-

signee). R. N. Sampson, J. Chottiner, and E. M. Petrie. U.S. Patent No 3,610,420, 4 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 891, No 1, p 179, October 5, 1971.

Descriptors: *Patents, *Water purification, *Water treatment, *Reverse osmosis, Equipment, Water quality control, *Membranes, Waste water treatment, *Resins, *Semipermeable membranes.

A porous, filament wound, hollow reverse osmo-sis tube is described. The wall of the tube contains multiple layers of resin impregnated bands and a semipermeable membrane consisting of graphitic oxide and modified cellulose acetate. The bands comprise roving bands laid at an angle between 15 and 75 deg to provide one diamond-shaped void per square inch of tube surface area. The bands form intermeshed helical opening webbing layers (Sinha-OEIS)

SEPARATOR-MELTER UNIT FOR DESALINA-

TION, Simon-Carves Ltd., Stockport (England). (as-

signee).
A. Martindale, B. R. Parr, and M. J. Smith.
U.S. Patent No 3,614,874, 5 p. 16 fig. 7 ref; Official Gazette of the United States Patent Office,
Vol 891, No 4, p 1339, October 26, 1971.

Descriptors: *Patents, *Desalination, Fresh water, Sea water, Saline water, *Ice, Equipment, Separation techniques, Crystals, Water treatment, Freezing. Identifiers: *Ice crystals.

An apparatus is provided for use in producing fresh water from a slurry of ice crystals in saline water. It consists of an internal melting chamber water. It consists of an internal metting chamber with an annular separating chamber surrounding it. The slurry passes upward through the separating chamber. A water spray washes the ice crystals. A rotatable plough is used to transfer the separated and washed ice crystals over the common wall and into the melting chamber to provide fresh water. (Sinha-OEIS) W73-03012

AN INTEGRATED SYSTEM FOR PROVIDING POWER, WATER AND FOOD FOR DESERT

Arizona Univ., Tucson. Environmental Research Lab. For primary bibliographic entry see Field 03F.

3B. Water Yield Improvement

IMPACT OF SNOWPACK MANAGEMENT ON SNOW-AND-ICE HYDROLOGY, Bureau of Reclamation, Denver, Colo. W. E. Howell.

Symposium on the Role of Snow Ice Hydrology, Banff, Canada, Sept 1972. 10 p, 3 tab, 2 ref.

management. Descriptors: "Snow management, "Weather modification, "Hydrologic aspects, Hydrology, Cloud seeding, Snowpacks, Precipitation (Atmospheric), Legal aspects, Political aspects, Water supply, Social aspects, Economic impact, Ecology, Snowfall, Temperature. Identifiers: Skywater Project, Orographic precipitation, Atmospheric research, Ice nuclei, Ice crystals.

Snowfall is no longer a wholly uncontrolled input Snowfall is no longer a wholly uncontrolled input to snow-and-ice hydrology. Snowpack management is economically effective in appropriate settings and is improving and expanding, even though still a primitive technology. Snow stimulation by professionally qualified meteorologists began in 1949; 6 projects have operated through most of the intervening winter seasons. Some meteorological situations are more susceptible to extificial simulation stem others. Experiments at meteorological situations are more susceptible to artificial stimulation than others. Experiments at Climax, Colo, showed precipitation to be near peak efficiency at cloud-top temperatures warmer than minus 23 deg C; seeding was not effective at temperatures warmer than approximately minus 8 deg C. Practical, technological, economic, ecological, social, and legal limitations to snowpack management, and the impact on hydrologic parameters are discussed. (USBR) W73-02851

CLOUD CHAMBER DESIGN FOR WATER EVAPORATION STUDIES, New Mexico State Univ., University Park. Dept.

For primary bibliographic entry see Field 02B. W73-02889

AN EXPANSION CLOUD CHAMBER STUDY OF WATER EVAPORATION, New Mexico State Univ., University Park. Dept.

of Physics. For primary bibliographic entry see Field 02B. W73-02890

PERFORMANCE OF AN ATMOSPHERIC WATER RESOURCES RESEARCH PROGRAM IN THE HUNGRY HORSE AREA, MONTANA.

Available from NTIS, Springfield, Va 22151 as PB-206 948; Price \$3.00 paper cover; \$0.95 microfiche. 1970-71 Season, 5th Interim Final Report, No 6-115, December 15, 1971. 107 p, 47 fig, 20 tab, append. BR-14-06-D-6039.

Descriptors: *Cloud seeding, *Weather modifica-tion, *Silver iodide, *Precipitation (Atmospheric), *Montana, Climatology, Meteorology, Cloud physics, Rainfall, Snowfall, Streamflow, Runoff, Water sources, Investigations, Methodology, Data collections, Evaluation, Water yield. Identifiers: *Increasing water supplies.

The Hungry Horse cloud seeding project in western Montana has completed 5 seasons of operations. The primary goal was to determine the feasibility of increasing water supplies through seeding methods, with a secondary goal of increasing runoff into the Hungry Horse reservoir. The investigations and results of 5 yrs of operation are summarized. Principal reliance for seeding was placed upon a network of upwind valley generators because of the inaccessibility of high-level sites. The use of target and control snow course measurements was developed, using historical measurements was developed, using historical regressions as a base relationship. Early and late readings found t was dev ments to nearby : gests tha get area USGS) W73-031

PROJEC Naval W T. L. Wri Available AD-742 microfich Publication ref. 2 app

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ject Fogg was base northern develop a in 17 test solution of 0.78 part 9:1. The o water. Se 1,000-galle 3,000-galle toward ra on the sur total fog la in a stead that were W73-03145

GROMET THE PHIL Naval Wes P. St-Amai Elliott. Available AD-723 8 microfiche Publication ref, 4 apper

Descriptors iodide, *We craft, Clou Crop respondentifiers:

1968 and 19 cloud seedi With the he seeding pro through mic silver iodide clouds. Thr seeding, inclarger cloud um of from seeded augmentatio calculated; from tropica a simple ope least in part, provement in

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Use of Water of Impaired Quality-Group 3C

readings of snow courses, to avoid storms, were readings of snow courses, to avoid storms, were found to introduce complications. A technique was developed to adjust snow course measurements to similar reading dates through reference to nearby rain gage data. An analysis of the 5-yr seeded period using this adjustment technique suggests that overall increases in snowpack in the target area are on the order of 10%. (Woodard-USGS) W73-03143

PROJECT FOGGY CLOUD III, PHASE 1, Naval Weapons Center, China Lake, Calif. T. L. Wright, R. S. Clark, and P. St-Amand. Available from NTIS, Springfield, Va 22151 as AD-742 081; Price \$3.00 paper copy; \$0.95 microfiche. Naval Weapons Center Technical Publication 5297, April 1972. 68 p. 59 fig, 9 tab, 8

Descriptors: *Fog, *Dispersion, *Weather modifi-cation, *California, Methodology, Aircraft, Con-vection, Atmospheric physics, Meteorology, Am-monia, Ureas, Testing procedures. Identifiers: *Fog seeding techniques, *Fog disper-sion, Visibility improvement.

From July 27 to October 24, 1970, Phase I of Prorom July 27 to October 24, 1970, Phase 1 of Pro-ject Foggy Cloud III was conducted. The project was based at the Arcata-Eureka Airport in northern California. The primary purpose was to develop an operational warm fog dispersal system. Nineteen tests were conducted. The seeding agent in 17 tests was a project-developed hygroscopic solution of ammonium nitrate, 3 parts urea, and 0.78 part water, giving a solids-to-water ratio of 9:1. The other two tests were conducted with tap water. Seeder aircrafts included a B-26 with a 1,000-gallon solution payload and a DC-7 with a 3,000-gallon payload. Emphasis was directed toward raising ceilings and improving visibilities on the surface rather than attempting to eliminate total fog layers. This was entirely possible on fogs total tog layers. This was entirely possible on fogs in a steady growth state; however, tests on fogs that were in a dynamic growth state produced less visible results. (Woodard-USGS) W73-03145

GROMET II-RAINFALL AUGMENTATION IN THE PHILIPPINE ISLANDS, Naval Weapons Center, China Lake, Calif. P. St-Amand, D. W. Reed, T. L. Wright, and S. D.

Available from NTIS, Springfield, Va 22151 as AD-723 815; Price \$3.00 paper copy; \$0.95 microfiche. Naval Weapons Center Technical Publication 5097, May 1971. 110 p, 55 fig, 15 tab, 4 ref. 4 append.

Descriptors: *Rainfall, *Cloud seeding, *Silver iodide, *Weather modification, Methodology, Airroute, Weather mountains, Methodology, Agriculture, Crop response, Data collections, Radar.
Identifiers: *Philippine Islands.

A severe drought in the Philippine Islands during 1968 and 1969 led the Philippine Government to try cloud seeding as a means of rainfall augmentation. With the help of the United States, a silver iodide seeding project, GROMET II, was conducted over the entire archipelago from the end of April through mid-June 1969. Pyrotechnically generated silver iodide was released in updrafts in growing siver iounce was released in uporatis in growing clouds. Through judicial placement and timing of seeding, individual clouds were organized into larger cloud systems. Rainfall estimated at a minimum of 30 billion cubic meters of water fell from seeded clouds. The precise extent of rainfall augmentation resulting from seeding cannot be calculated; nonetheless, rainfall augmentation from tropical cumulus clouds was accomplished in a simple operational manner. Benefits derived, at least in part, from the preject included marked im-provement in agriculture, increased sugar produc-tion amounting to 43 million U.S. dollars, and augmented crops of rice and corn sufficient to make anticipated importation unnecessary. (Woodard-USGS) W73-03149

3C. Use of Water of Impaired **Ouality**

EFFECTS OF DETERGENT POLLUTED WATER ON SOIL REACTION AND PLANT GROWTH, Virginia Polytechnic Inst. and State Univ.,

Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C. W73-02620

DYNAMICS OF NITRIC AND AMMONIA NITROGEN ACCUMULATION IN THE SOIL, IN THE INTERVAL BETWEEN WATERING IN THE CASE OF SPRINKLING AND BED IR-RIGATION OF MAIZE, Institutul Agronomic, Iasi (Rumania). E. Albinet, and O. Tomita. Inst Agron 'Ion Ionescu De La Brad' Iasi Lucr

Stiint I. Agron-Hort. p 153-163. Illus. 1970. English

Identifiers: *Irrigation effects, *Nitrification, Accumulation, Ammonia, Dynamics, Intervals, Irrigation, Maize M, Nitric, Nitrogen, Soils.

NO3 and NH4 accumulations were studied before and after watering in the interval between watering in sprinkling and bed irrigation on an alluvial soil. The irregular micro-relief produced by bed irriga-tion creates more favorable conditions for NO3 accumulation, considerably increasing the amounts as against sprinkling irrigation. Though sprinkling moistens the surface layer uniformly, nitrification is impaired by surface compression and crust formation. The amounts of NO3 and NH4 accumulated in the soil have an inverse correlation, caused by soil moistening by the 2 water-ing methods. These methods create different conditions, characteristic of the nitrification and ammonia-formation processes.--Copyright 1972, Biological Abstracts, Inc. W73-02669

INVESTIGATIONS ON THE DEVELOPMENT OF SOME ORNAMENTAL WOOD SPECIES ON ERODED SALINE SOIL OF THE MOUTH OF JIJIA-BAHLUI DEPRESSION, (IN RUMANIAN), Institutul Agronomic, Iasi (Rumania). C. Tesu, and L. Palade.

Inst Agron 'Ion Ionescu De La Brad' Iasi Lucr Stiint I. Agron-Hort. p 63-70. 1970. Illus. English

Identifiers: Acer negundo D, Cornus sanguinea D, Cotinus coggygria D, Elaeagnus angustifolia D, Eroded aoils, Euonymus europaea D, Fraxinus ex-celsior D, Quercus robur D, Robinia pseudoacacia D, *Romania, *Saline, Soils, *Wood species, Soil

Soil erosion causes intense degradation of the ground, by bringing to the surface more saline deep layers having negative effects on woody plant development. A total amount of salt exceed-ing 250 mg/100 g soil reduced plant development by 50% of that attained on non-eroded, nons soils of Quercus robur, Fraxinus excelsoir, Evonymus europaea, Robinia pseudaccacia, Acer negundo, Cotinus coggygria, Elaeagnus angustifolia and Cornus sanguinea. E. angustifolia and C. sanguinea grow on intensely eroded soils with slight average salinization. R. pseudacacia show lower development with slightly sline, eroded soils.--Copyright 1972, Biological AbSODIUM EXPORT FROM BEAN LEAVES AS AFFECTED BY THE MODE OF APPLICATION, Hebrew Univ., Rehovoth (Israel). Dept. of Agricultural Botany. For primary bibliographic entry see Field 021. W73-03073

SALT INJURY TO PLANTS WITH SPECIAL

REFERENCE TO CATIONS VERSUS ANIONS AND ION ACTIVITIES, California Univ., Riverside. Dept. of Soil Science. F. M. Eaton, W. R. Olmstead, and O. C. Taylor. Plant and Soil, Vol 35, No 3, p 533-547, 1971. 5 tab,

Descriptors: "Phytotoxicity, "Cations, "Anions, "Soil chemical properties, "Bioindicators, Soil contamination effects, "Absorption, "Salt tolerance, Water quality, Crop response, Enzymes, Ions, Soil chemistry, Osmotic pressure, Phioem, Xylem, Plant physiology, Soil investigations, Salts, Saline soils, Soil water movement, Growth chambers, Soil-water-plant relationships.

Irrigation agricultures tend to be characterized by varying degrees of crop injury as a result of accu-mulations in soils of salts added by water supplies. In contrast with the toxicities of sulfate and chloride salts added to substrates, the anions SO4 and C1 were not injurious when accumulated without leaf burning by cotton and tomato plants from atmospheres enriched with SO2 or HC1 gases. The foregoing results are discussed in terms of cation-enzyme interactions which appear to or cation-enzyme interactions which appear to represent at least a major cause of salt toxicity. Although anions are largely unreactive with en-zymes, it has long been observed that chloride salts in soil solutions are far more toxic than sulfate salts. The osmotic differentials (average about 10 atm) between the expressed tissue fluids and these substrate solutions were remarkably uniform within species. It is projected that the downward transport of salts via the phloem provides for root concentrations which supply ions to the xylem and thereby control the uptake of substrate salts. (Black-Arizona)
W73-03077

EFFECTS OF SALT TREATMENTS OF COT-TON PLANTS (GOSSYPIUM HIRSUTUM L.) ON LEAF MESOPHYLL CELL MICROSTRUC-TURE, Agricultural Research Service, Weslaco, Tex. Soil

and Water Conservation Research Div. H. W. Gausman, P. S. Baur, Jr., M. P. Porterfield,

Agronomy Journal, Vol 64, No 2, p 133-136, March-April 1972. 1 tab, 2 fig, 21 ref.

Descriptors: "Hydroponics, "Cytological studies, "Salt tolerance, "Absorption, "Electron microscopy, Salts, Cotton, Agronomic crops, Growth chambers, Laboratory tests, Nutrient require-ments, Saline water, Environmental control, Plant physiology, Plant morphology.

Cotton plants (Gossypium hirsutum L.) were grown hydroponically in a controlled environment to study the effect of three salt treatments on the microstructure of leaf mesophyll cells, and to test the premise that such effects would affect light scattering. However, only observed changes on cell microstructure are reported. Sodium chloride was added to a basic nutrient solution in amounts to give low, medium and high salt treatments.

Leaves of the same chronological age from the fifth true node were used for electron microscopic fifth true node were used for electron microscopic studies of mesophyll cell microstructure. Electromicrographs showed many crystalline deposits in leaf mesophyll cells for the low and high salt treatments, but not for the medium salt treatment. Heavy deposits of these crystals occurred in the cytoplasm, central vacuole, cell walls, and intercellular spaces. The high salt treatment also produced many necrotic mesophyll cells and

Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C-Use of Water of Impaired Quality

changes in chloroplast ultrastructure, and more mitochondria than cells from the medium and low salt treated leaves. (Black-Arizona)

INTERACTION OF TEMPERATURE AN SALINITY ON SUGAR BEET GERMINATION, Agricultural Research Service, Riverside. Soil a
Water Conservation Research Div.
L. E. Fracois, and J. R. Goodin.

omy Journal, Vol 64, No 3, p 272-273, 1972.

1 tab, 1 fig. 11 ref.

Descriptors: "Environmental effects, "Salt tolerance, "Germination, "Limiting factors, "Thermal stress, Agriculture, Saline soils, Southwest U.S., Soil-water-plant relationships, Temperature, Salinity, Heat resistance, Physiological coolers, Plant, Physiology, "Spury, beat, Plant, Physiology, "Spury, Plant, P ical ecology, Plant physiology, *Sugar beets,

se high temperatures and soil salinity adversely affect sugarbeet (Beta vulgaris L.) germina-tion in the southwestern United States, the interaction of temperature and salinity on germ tion was studied by a modification of the standard blotter technique. The interaction was highly sig-nificant. Salinity had little effect on germination at 10 degrees C and 15 degrees C but was increas-ingly inhibitory as temperature increased from 25 degrees C to 40 degrees C. Germination was maximum at 25 degrees C, with low salinity, and almost completely inhibited at 45 degrees C with all nity levels. Of the four varieties studied, 'US-H2', 'US-H6', 'US-H8', and 'HH-5', germination of the US-H2 variety was most sensitive to salinity over the 30 degrees C to 40 degrees C range. (Black-Arizona) W73-03084

VARIATIONS IN SODIUM UPTAKE ALONG PRIMARY ROOTS OF CORN SEEDLINGS, Tel Aviv Univ. (Israel). Dept. of Botany.

A. Eshel, and Y. Waisel. Plant Physiology, Vol 49, No 4, p 585-589, 1972. 2 tab, 3 fig, 27 ref.

Descriptors: *Moisture uptake, *Absorption, *Osmosis, *Corn, Plant *Plant physiology, *Osmosis, *Corn, Plant growth, Root development, Analytical techniques, Mathematical studies, Sodium, Soaking, Seeds, Laboratory tests, Ions

Roots are not uniform organs, and designation of certain root segments as 'absorbing zones' has been used by plant physiologists for a number of years. Entry of Na + into segments of the apical 8-centimeter portion of corn (Zea mays) roots was investigated and analyzed for each centimeter seg-ment separately. Influence of temperature in the 0 degrees C to 30 degrees C range was well described by the Arrhenius equation (U±a exp(-Ea/RT). Values of A and Ea differed for each segment, tending to lessen with increasing distance from root apex. Time course of Na+ entry was followed up to 70 minutes. Time relations of the process fit well the expression U±m (1-exp (-nt)). Calculated maximal uptake capacity (m) diminished with increasing distance from the apex. The data presented indicate that sodium uptake resolucity super the state of the state o mechanisms vary qualitatively and quantitatively along corn roots. Thus, the use of entire roots for characterization of uptake mechanisms should be reassessed. (Black-Arizona) W73-03085

SALT TOLERANCE OF SAFFLOWER VARIE-TIES (CARTHAMUS TINCTORIUS L.) DURING

TIES (CARTHAMUS 11NC-10RGS L.) DORARG GERMINATION, Pahlavi Univ., Shiraz (Iran). Coll. of Agriculture. S. R. Ghorashy, N. Sionit, and M. Kheradnam. Agronomy Journal, Vol 64, No 2, p 256-257, March-April 1972. 1 fig, 8 ref.

Descriptors: *Salt tolerance, *Oilseed crops, Descriptors: "Salt tolerance, "Ouseed Crops, "Germination, "Plant physiology, 'Varieties, Crop response, Salinity, Saline soils, Growth chambers, Agronomic crops, Viability, Soil environment, Soil-water-plant relationships, Irrigation effects. Identifiers: Plant selection.

Safflower is an oil-seed crop well adapted to the semi-arid regions of the world. In these areas accu-mulation of salts in irrigated soils may reduce germination, growth, and eventually the yield of this crop. Varietal differences with respect to salt tolerance have been observed in various crop spetoserance nave been observed in various crop spe-cies. Knowledge of such differences in safflower is of potential importance. Effects of seven salini-ty levels (0 to 2 percent NaCl) on germination of three safflower varieties_were determined under controlled temperature. The varieties were 'Ute', Iranian local 3151, and Iranian local 2811. The three varieties showed a similar trend in germina-tion reduction as salinity increased from 0 to 1 per-cent NaCl. However, Iranian local 3151 showed the least reduction in percent germination, as com-pared with the other two at NaCl concentrations greater than 1 percent. (Black-Arizona) W73-03088

THE INFLUENCE OF LOW SUBSTRATE SODI-UM LEVELS UPON THE FREE AMINO ACID CONTENT OF COTTON LEAVES, Texas A and M Univ., College Station. Dept. of

Plant Sciences. R. H. Pluenneke, and H. E. Joham.

Plant Physiology, Vol 49, No 4, p 502-505, 1972. 4 tab. 1 fig. 7 ref.

Descriptors: *Amino acids, *Cotton, Moisture up-Descriptors: Amino acus; Cotton, motute up-take, "Sodium, "Absorption, Plant physiology, Ions, "Osmosis, "Bioassay, "Nutrient require-ments, Chemical analysis, Plant growth, Analyti-cal techniques, Laboratory tests, Growth cham-bers, Greenhouses, Artificial substrates, Agronomic crops.

The essentiality of sodium in the development of certain plants (e.g. blue-green alga (Anabaena cylindrica), Atriplex nummularia, Atriplex vesicaria) has been established. The sodium nutrivesicaria) has been established. In esocium nutrition of cotton (Gosspojum hirsutum L.) was investigated in the study where plants were grown in purified nutrient solutions within a chamber designed to minimize sodium contamination. Three nutrient solutions were employed that contained in microequivalents/liter: (a) 0.17 Na, (b) 43.5 Na and (c) 0.75 Cs, 14.41 Li, and 1.17 Rb. All solutions had adequate potassium. Total free amino acids were increased by sodium. Leaves from plants grown in the high sodium solution contained significantly more free asparagine, arginine, and methionine than leaves from plants of the other treatments. The other alkali metals had little or no effect on concentrations of the free amino acids. An unknown was tentatively identified as argininosuccinic acid. (Black-Arizona) W73-03089

CALCIUM AND SALT TOLERATION BY BEAN PLANTS, California Univ., Davis, Dept. of Soils and Plant

P. A. Lahaye, and E. Epstein. Physiologia Plantarum, Vol 25, No 2, p 213-218, 1971. 10 fig, 31 ref.

Descriptors: *Salt tolerance, *Saline soils, Plant growth, *Inhibitors, *Plant growth regulators, *Soil-water-plant relationships, Plant physiology, Translocation, Biochemistry, Physiological ecology, Aqueous solutions, *Beans.

In salt-affected environments, sodium usually is the principal problem ion. It is excluded from the tops of most crop plants. The role of calcium in the salt relations of the bean plant, Phaseolus vulgaris, was studied. Brittle wax bush bean plants were

cultured in nutrient solutions containing 50 mm NaCl. In the absence of added calcium the plants showed a general breakdown of the roots. A low concentration of calcium in the nutrient solution prevented this. Without added calcium the plants absorbed and translocated sodium at such a rate that high concentrations of it built up in the leaves with high concentrations of it built up in the leaves. that high concentrations of it built up in the leaves within two days. With increasing concentrations of calcium in the nutrient solution the leaves contained progressively less sodium, and at 3 mm CaSO4 the concentration of sodium in the leaves was equal to that of the control plants grown without addition of salt. Even after both roots and stems had reached a high concentration of sodium, the leaves of plants grown in the presence of adequate concentrations of calcium contained lit-tle sodium. (Black-Arizona) W73-03094

SEED PELLETING IN RELATION TO NODU-LATION AND NITROGEN FIXATION BY PHASEOLUS AUREUS L. IN A SALINE ALKALI

Indian Agricultural Research Inst., New Delhi. Div. of Microbiology. P. K. Chhonkar, V. Iswaran, and K. S. Jauhri. Plant and Soil, Vol 35, No 2, p 449-451, 1971. 1 tab,

Descriptors: "Plant growth, "Seeds, "Seed treatment, "Plant growth regulators, "Salt tolerance, "Plant physiology, Legumes, Nitrogen fixation, Saline soils, Alkalinity, Agricultural chemicals, Alkaline soils, Inhibitors.

In saline alkali soils, legumes grow poorly due to reduced nodulation. Seed pelleting with various coating materials has been shown to overcome nodulation failure in problem soils. Using a saline alkali soil, it was found that pelleting of Phaseolus aureus L. seeds with time and gypsum, together with Rhizobium inoculation, significantly increased growth, nodulation and nitrogen fixation. Seed pelleting provides protection against unfavorable soil conditions such as soil desiccation and soil acidity. Pelleting may provide a better en-vironment for rhizobia to develop and establish in rhizophere during preinfection stages. (Black-

Arizona) W73-03097

RESPONSE OF OSMOTICALLY STRESSED PLANTS TO GROWTH REGULATIONS,

Arizona Univ., Tucson. Environmental Research

Lab. J. W. O'Leary, and J. T. Prisco. Advancing Frontiers in Plant Sciences, Vol 25, p 129-139, 1970. 3 fig, 5 tab, 17 ref.

Descriptors: "Plant growth regulators, Plant physiology, "Translocation, "Cytological studies, "lahibitors, "Salt tolerance, Soil-water-plant relationships, Chlorophyll, Laboratory tests, Saline water, Saline soils, Plant growth, Plant growth substances substances.

Cytokinins apparently are synthesized in roots, and they have been detected in the bleeding stream from truncated root systems. Since cytokinins presumably control activities in the leaves, it seems likely that a normal feature of a plant's seems inkey that a normal returne or a plant's physiology involves synthesis of cytokinins or similar substances in the roots and subsequent transport to the leaves. Chlorophyll content in detached leaves of Phaseolus vulgaris L. plants was therefore measured at daily intervals up to five days after detachment. Chlorophyll decay occurred much more rapidly in leaves from plants subjected to four bars of added NaCl in the growth medium than in leaves from plants without added NaCl. Both salinized and non-salinized plants were sprayed with growth hormones. None of the sprays increased fresh weight of control plants, but both benzyladenine (BA) and gibberellic acid (GA) increased fresh weight of salt-treated plants.

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Descriptor *Groundwa *Michigan, utilization, data colle recharge, Chemical a Identifiers:

Oakland C miles in sou

of the coun living in th gallons of w used for la came from annual rate about 370 m d). M from 0 to 0. be augment water captu struction of sites. Glacia are the prim that penetral in the northy least 50 gpm yield more th which occur yielding mor good through part of the co acceptable s (Woodard-U W73-02804

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Industry—Group 3E

Salt increased resistance of roots to water flow, and none of the spray treatments influenced this effect. Salt increased leaf resistance to water vapor diffusion also. Both BA and GA reduced this effect, but kinetin magnified it. Results support the hypothesis that a major effect of increased salinity in the root environment is a reduction of hormone delivery from roots to leaves. (Black-Arizona) W73-03104

3D. Conservation in Domestic and Municipal Use

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1970,

IN THE DALLAS, IEAAS METROPOLE AREA, 1970, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W73-02652

INTEGRATED MANAGEMENT OF QUANTITY AND QUALITY OF URBAN WATER RESOURCES, Texas A and M Univ., College Station. Dept. of In-

Texas A and M Univ., College Station. Dept. of Industrial Engineering. For primary bibliographic entry see Field 05G. W73-02666

URBAN SEDIMENTATION--IN PERSPECTIVE, Geological Survey, Reston, Va. For primary bibliographic entry see Field 02J. W73-02793

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WATER FOR A RAPIDLY GROWING URBAN COMMUNITY-OAKLAND COUNTY, MICHIGAN,

MiCHIGAN, Geological Survey, Lansing, Mich. F. R. Twenter, and R. L. Knutilla. Available from GPO, Washington, DC 20402, Price \$1.00 (Paper cover). Geological Survey Water Supply Paper 2000, 1972. 150 p, 90 fig, 16 tab, 67 ref.

Descriptors: *Water supply, *Urbanization, *Groundwater resources, *Surface waters, *Michigan, Water demand, Water yield, Water utilization, Water quality, Hydrologic data, Basic data collections, Streamflow, Groundwater recharge, Water wells, Aquifer characteristics, Chemical analysis, Water resources development. Identifiers: *Oakland County (Mich).

Oakland County includes an area of 899 square miles in southeastern Michigan. The southern part of the country is overalpped by the suburbs of the city of Detroit. In 1970, about 850,000 people were living in the county and using about 100 million gallons of water a day. More than 80% of the water used for large industrial and municipal supplies came from Detroit's water system. The average annual rate of stream flow from the county is about 370 million gallon per day (575 cubic feet per second). Median annual 7-day low flows range from 0 to 0.25 cfs per square mile. Low flows can be augmented by more than 60,000 acre-feet of water captured during high streamflow by construction of small reservoirs at 21 inventoried sites. Glacial deposits and the Marshall Sandstone are the prime sources of groundwater. Most wells that penetrate the full thickness of glacial deposits in the northwestern part of the county will yield at least 50 gpm (gallons per minute), and many will yield more than 400 gpm. The Marshall Sandstone, which occurs only in the Holly area, is capable of yielding more than 1,000 gpm. The chemical quality of both surface and groundwater is relatively good throughout the county. Son the southern part of the county is the dissolved solids above the acceptable standard of 500 milligrams per liter. (Woodard-USGS)

GROUND-WATER RESOURCES AND GEOLO-GY OF COOK COUNTY, GEORGIA, Geological Survey, Atlanta, Ga. For primary bibliographic entry see Field 04B. W73-02807

CHEMICAL AND BACTERIOLOGICAL QUALITY OF WATER AT SELECTED SITES IN THE SAN ANTONIO AREA, TEXAS, AUGUST 1968-APRIL 1972,

SAN ANTONIO AREA, TEXAS, AUGUST 19-APRIL 1972, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 05B. W73-0280

THE RIVER BASIN MODEL: THE SOCIAL SCIENCE LABORATORY.
Environetrics, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W73-02853

COMPREHENSIVE SURVEY OF ELK RIVER BASIN, VOLUME II, ECONOMIC BASE STU-DY,

West Virginia Dept. of Natural Resources, Charleston. Div. of Water Resources. For primary bibliographic entry see Field 06D. W73-02860

THE COMING TECHNICAL REVOLUTION IN METER READING, Philadelphia Suburban Water Co., Bryn Mawr. Pa. For primary bibliographic entry see Field 07B. W73-02863

A BUSINESSLIKE APPROACH TO FIRE PR-TOECTION CHARGES.

American Water Works Association, New York.
Committee on Financial Aspects of Fire Prevention and Protection

Presented at American Water Works Association Annual Conference, Denver, Colorado, June 15, 1971. 16 p, 5 ref.

Descriptors: *Cost allocation, *Cost analysis, *Water distribution (Applied), Cost repayment, Municipal water, Industries, Distribution systems, Water demand, Water supply, Systems analysis, Insurance.

Identifiers: *Fire safety, *Fire protection, Fire fighting, Water distribution.

Besides providing water for everyday uses, it is the responsibility of water utilities to provide for fire protection. This factor must not be underestimated, for The American Insurance Association grading schedule puts the grading of the water system as the single largest factor (34%) in the fire insurance rating of a city. Although fire protection is of minor importance in terms of quantity of water used, it is an important consideration and involves factors of system reliability, capacity, location, and pressure. Fire protection is furthermore of two types-public fire protection, and private fire protection for business and industry. It is recommended that general public funds be used to provide general public fire protection and that the cost of fire protection be computed on the basis of the added cost of providing this service. Thus, if the city could use a 6-inch pipe with fire protection, but needs an 8-inch pipe with fire protection, but needs an 8-inch pipe with fire protection, mater bills; for example, this would charge a laundry more than a lumber yard for fire protection, an unfair system. For private business and industrial protection, only the out-of-the-pocket costs of a private fire system should be borne by the firm and not the extra system capacity. In computing future pipe size, it is important to prvide for realistic capacities for future fire protection. (Poertner)

THURSTON COUNTY, A COMPREHENSIVE WATER AND SEWERAGE PLAN, VOLUME II, WATER PLAN. Cornell, Howland, Hayes and Merryfield, Seattle, Wash. For primary bibliographic entry see Field 06D. W73-02865

'APOLLO COUNTY PARK', WASTE WATER RECLAMATION PROJECT FOR THE ANTELOPE VALLEY AREA, LOS ANGELES COUNTY.
Los Angeles Dept. of County Engineer, Downey, Calif. Sanitation Div.
For primary bibliographic entry see Field 05D.
W73-02867

WATER REQUIREMENTS OF SANTA BAR-BARA COUNTY, 1967 TO 1990, Bookman and Edmonston, Glendale, Calif. For primary bibliographic entry see Field 06D. W73-0286

AN EXPERIMENT IN COMPUTER-ASSISTED SUPERVISORY CONTROL OF A WATER DISTRIBUTION SYSTEM, General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div. For primary bibliographic entry see Field 04A. W73-02871

WATER AND OUR FUTURE: AN URBAN PLANNING MANUAL FOR LOCAL OFFI-CIALS, National Association of Counties Research Foundation, Washington, D.C. For primary bibliographic entry see Field 06B.

THE FUTURE HUMAN OCCUPANCE OF THE ARID SOUTHWEST, Arizona Univ., Tucson. Dept. of Geography and Area Development. For primary bibliographic entry see Field 06B. W73-03121

PLANNING OUR URBAN ENVIRONMENT IN THE SOUTHWEST, Arizona State Univ., Tempe. Dept. of Political Science.

Science.
For primary bibliographic entry see Field 06B.
W73-03124

NEW TOWNS FOR THE SOUTHWEST, Colorado Univ., Boulder. For primary bibliographic entry see Field 06B. W73-03125

3E. Conservation in Industry

WATER FOR INDUSTRIAL DEVELOPMENT IN COPIAH AND SIMPSON COUNTIES, MISSIS-SIPPI.

Geological Survey, Jackson, Miss. R. Newcome, Jr., E. J. Tharpe, and W. T. Oakley. Mississippi Research and Development Center, Jackson, Report, 1972. 60 p., 22 fig, 14 tab, 26 ref.

Descriptors: *Water resources development, *Groundwater resources, *Surface waters, *Industrial water, *Mississippi, Water supply,
Streamflow, Aquifers, Water yield, Water quality,
Hydrologic data, Data collections, Chemical
analyses, Aquifer characteristics.
Identifiers: *Copiah County (Miss), *Simpson
County (Miss),

Copiah and Simpson Counties in southwestern Mississippi, have substantial amounts of water in

Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3E—Conservation in Industry

streams and underground. Present withdrawals for public and industrial use are from wells and total about 4 mgd. Surface water of a chemical quality suitable for many industrial uses is available. Seven streams have minimum flows as great as 5 mgd. Of these, the Strong River has a flow of 45 mgd below Big Creek and the Pearl River 180 mgd below Rockport during extended dry periods. Water from the Pearl River is suitable for most uses after some treatment. The Strong River, Bayou Pierre, and smaller streams could furnish water supplies requiring little or no treatment. Considerable quantities of groundwater are available for development. The fresh-water section, which is at least 2,000 feet thick in most of the two county area, contains many sand beds capable of supplying large-capacity wells. The bods of Miocene age and sand in the Citronelle Formation, the primary sources of existing water supplies do sand occur, large supplies can be developed; and in some places well fields could be constructed to produce 10 mgd or more. (Woodard-USGS) W73-02651

WATER RESOURCES OF THE USPENSKIY MINING DISTRICT AND A TECHNICAL AND ECONOMIC JUSTIFICATION OF THEIR USE (VODNYYE RESURSY USPENSKOGO RUD-NOGO POVASA I TEKHNIKO-EKONOMICHESKOYE OBOSNOVANIYE IKH

-EKONOMICHESKOYE OBOSNOVANIYE IRH ISPOL'ZOVANIYA), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-stitut Gidrogeologii i Gidrofiziki. For primary bibliographic entry see Field 04B. W73-02814

COMPREHENSIVE SURVEY OF ELK RIVER BASIN, VOLUME II, ECONOMIC BASE STU-

leston. Div. of Water Resources, C leston. Div. of Water Resources. For primary bibliographic entry see Field 06D. W73-02860 West Virginia Dept. of Natural Resources, Char-

NET A PROFIT FROM FARM FISH CROP.

Farmers Weekly, Vol 76, No 25, p 44, June 23,

Descriptors: *Fish farming, *Investment, Profit, Ponds, Construction costs, Operating costs. Identifiers: *Cost reductions, Fiber glass ponds,

Modern management and husbandry techniques have reduced the factor input costs of fish farming. Consequently, farmers willing to fish farm on a small scale and develop their own markets with local hotels and restaurants may enjoy large profits. Small-scale fish farming requires a relatively small initial investment. An initial purchase of 1,000 trout fry, for example, costs 1.50 British pounds. They require two small glass fibre ponds costing 55 paugeds each, and after about 4 weeks. costing 55 pounds each, and after about 4 weeks, can be moved to two larger rearing tanks costing 350 pounds each. These new glass fibre pools represent one of the major reasons for lowered production costs. The traditional concrete or earth ponds are much more expensive. Feed costs are 130 pounds a ton for a high-protein, dry feed. The 75 lbs a day from self-feed hoppers hung over the ponds. At two years, trout weigh about 2-2 1/2 lbs. ponds. At two years, trout weign about 2-2 1/2 105.
With proper management, the annual return from
this scale of operation should reach 1,000 British
pounds. (Settle-Wisconsin)
W73-02924

CATFISH PRODUCTION IN SOUTHEASTERN ARKANSAS: ESTIMATED

REQUIREMENTS, COSTS, AND RETURNS, FOR TWO SIZES OF FARMS, Arkansas Univ., Fayeteville. Dept. of Agricultural Economics and Rural Sociology.
C. R. Garner, and W. A. Halbrook.
Arkansas Agricultural Experiment Station, FayetSOVBEAN CROPS,

teville, Report Series No. 203, August, 1972. 27 p, 2 fig, 10 tab, 1 append.

Descriptors: "Fish farming, "Catfishes, "Operating costs, "Fixed costs, Investment, Economies of scale, Profit, Arkansas. Identifiers: Production.

The costs of and returns to commercial catfish production in southeastern Arkansas are investigated. The study focuses on two hypothetical operations, (1) a 40-acre catfish farm with one 33-acre reservoir, and (2) a 160-acre catfish farm with four 33-acre reservoirs. The investment capital required for the purchase of land, equipment, buildings, and construction of levees was estimated to be \$39,589 for the small farm and \$125,186 for the large one. Annual fixed costs for depreciation, interest, taxes, and insurance on the investment items amounted to \$3,647 for the annual depreciation, interest, taxes, and insurance on the investment items amounted to \$3,647 for the small farm and \$11,352 for the larger farm. Annual variable operating costs for fingerlings, feed, labor, fuel, electricity, and other operating items totaled \$13,014 for the small farm and \$44,661 for the large one. Based on an estimated yield of 1,500 pounds of marketable fish per acre and a market series of \$0.35 are round, gross returns, we returns, when the state of \$1.00 for th pounds of marketable fish per acre and a market price of \$0.35 per pound, gross returns were \$17,325 for the small farm and \$69,300 for the large one. Return to management and risk was \$664 for the small farm and \$13,287 for the large one, or on a per-acre-of-water basis, \$20 per acre and \$101 per acre, respectively. (Settle-Wisconsin) W73-02926

SURVEY OF THE MERCURY REPROCESSING INDUSTRY, 1968-1970, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05G. W73-02931

COMMERCIAL SHRIMP FARMING.....NEAR-

ING REALITY, Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences J. C. Parker.

Texas Agricultural Progress, Vol 18, No 3, p 13-16, Summer, 1972. 7 fig.

Descriptors: *Shrimp, *Fish farming, Foods,

Profit, Texas.
Identifiers: *Shrimp farming, *Commercial opera-tions, *Brown shrimp, White shrimp, Growth.

Within the next few years commercial shrimp farming may develop into a significant income resource for Texas' more than 300,000 acres of coastal lowlands. A team of Texas A and M resource for Texas' more than 300,000 acres of coastal lowlands. A team of Texas A and M University personnel is working closely with coastal farmers, industry, and local governments to develop operational guidelines for commercial shrimp farming. Results of previous research indicate that (1) white shrimp (Penaeus setiferus) may yield upwards of 800 pounds per acre in about 90 days, compared to less than 250 pounds per acre for brown shrimp (Penaeus aztecus); (2) ponds can be designed for harvesting via a drain pipe to yield 100 percent of the crop; and (3) usage of new flake-like rations can increase growth rates beyond that obtained with natural foods. With present technology, white shrimp appear better suited than brown shrimp for edible shrimp roduction because they can be maintained at higher densities and grown to a larger size in a shorter time. The following two major problems continue to hinder profitable commercial operations: (1) a good survival rate cannot be assured, and (2) hatcheries cannot yet supply desired species on demand. (Settle-Wisconsin)

RELATIONSHIP OF PLANT MOISTURE STATUS TO IRRIGATION NEED IN CORN AND SOYBEAN CROPS, Illinois Univ., Urbana. Water Resources Center.

For primary bibliographic entry see Field 02I. W73-02604

SOIL ASSOCIATIONS AND LAND CLASSIFI-CATION FOR IRRIGATION, LINCOLN COUN-

TY, New Mexico Agricultural Experiment Station, University Park. H. J. Maker, M. T. Turner, W. B. Gallman, and J.

U. An

Available from the National Technical Information Service as PB-213 457, \$3.00 in paper copy, \$0.95 in microfiche. New Mexico State University, Agricultural Experiment Station Research Report 212, 1971. 49 p. 2 fig, 7 tab, 7 ref. OWRR B-015-

Descriptors: "New Mexico, "Irrigable land, "Soil classification, "Land classification, Soil investigations, Agriculture, Irrigation.
Identifiers: "Lincoln County (N Mex), "Soil associations, "Irrigation potential, Soil interpretation, Soil characteristics, Soil description.

Information is presented on the suitability of soils in Lincoln County, New Mexico for irrigation. The acreage, general location, and relative capability of the soils for use in irrigated agriculture are given. The general soil map based on a reconnaisance soils survey, provided the information necessary for the classification for irrigation. The necessary for the classification for irrigation. The data were organized and presented on the basis of soil associations shown on the general soil map and on the irrigation land classification map. Lincoln County has a total of about 3,109,800 acres, of which about 21 percent were considered suitable for irrigation. About 13,935 acres were in irrigation class 1; 245,685 acres in class 2; 314,571 acres in class 3; and 77,414 acres in class 4. The remaining 458, 195 acres in the county were in land remaining 458,195 acres in the county were in land class 6, which was not considered suitable for irrigation. Information is provided on soil resources rigation. Information is provided on soil resources that can be used for preliminary planning for irrigated agriculture, forestry, range, urban, engineering, recreation, and wildlife uses. A general soil map and a classification of land for irrigation map, both in color, are included. (Creel-New Mexico Sistel) W73-02623

CONTRIBUTION TO THE KNOWLEDGE OF THE GROWTH OF THE MAIZE ROOT SYSTEM UNDER IRRIGATION CONDITIONS, Institutul Agronomic, Iasi (Rumania). E. Albinet.

Inst Agron 'Ion Ionescu De La Brad' Iasi Lucr Stiint I. Agron-Hort. 1970: p 165-176. Illus. 1970.

English summary. Identifiers: "Irrigation effects, Growth, Irrigation, Maize M, "Root systems, Fertility, Root distribu-

The influence of sprinkling and bed irrigation, and of soil fertility on the root penetration, spreading and depth distribution was studied on an alluvial soil. Most of maize roots occurred at a 70 cm soil. Most of maize roots occurred at a 70 cm depth. Radially they are interpenetrating 80 or 100 cm between rows. In the case of sprinkling irrigation, roots are more superficial. In bed irrigation, they are directed to the moistened bottom of the bed. Fertilization results in a greater root mass while irrigation cereases it. They decrease more in bed irrigation. The main root mass appears in the 0-40 cm layer. The known active layer of 75 or 80 cm meets exploited requirements.—Copyright 1972, Biological Abstracts, Inc.

IRRIGA" GROWN IN THE SYSTEM Academy garia). E B. Licher Rasteniev English s Identifier *Maize M

The 2 pos ble irriga yields we ions thro soil mois capacity periods of moisture capacity.
fall, the in
applicatio
of water/ silage mai m/ha. Hig served at i tion range requireme formation the soil fre wetted at t ecure its and regula may be so after plant catch crop air dry or 5170-68101 ganic subs Biological W73-02670

CONTRIB POSSIBILI PYRETHR SERVIA PORT, Belgrad Un R. Ivanic, a Glas Srp A Identifiers: cinerariaefo Crop yield,

The possibi different c Each site of found suits Voyvodina It was resis 28.5C at Kl 12% higher Adriatic. Th in spite of t and especial tive influence yield. In case rigation is a (dunes, mov of Kladovo, dry floral Copyright 19 W73-02671

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WATER SUPPLY AUGMENTATION AND CONSERVATION-Field 03

Conservation in Agriculture—Group 3F

IRRIGATION OF MAIZE AND SUNFLOWER GROWN AS POST-HARVEST SILAGE CROPS IN THE REGION OF ROSSITZA IRRIGATION

Academy of Agricultural Sciences, Pavlikeni (Bul-garia). Experiment Station of Irrigated Agricul-

Rastenievod Nauki. Vol 8, No 5, p 117-124, 1971.

English summary.
Identifiers: *Bulgaria, Crops, Harvest, *Irrigation, *Maize M, Rossitza, Silage, *Sunflower D, Yield.

The 2 post-stubble crops were a comparatively sta-ble irrigation regime. The highest green mass yields were obtained from single water applica-tions throughout the maize vegetation period at soil moisture levels reduced to 80% of the field capacity and from waterings during the 2 sub-periods of sunflower vegetation made at soil moisture levels reduced to 80-70% of the field moissure levels reduced to 80-109-6 of the field capacity. Depending on the temperature and rainfall, the irrigation regime may be maintained by 2-4 applications at the rates from 500-600 cubic (cu) m of water/ha. The consumptive use of water of silage maize varied from 2600-3500 cu m/ha and snage maze varied from 2000-3500 cu m/ha and the daily water requirement varied from 32-38 cu m/ha. Highest daily water requirement was observed at the tasseling and flowering stages, within 42 and 63 cu m/ha. The sunflower evapotranspiration ranged from 2000-2520 cu m/ha and the daily water requirement from 27-37 cu m/ha; the highest requirement varied (see 1.52). water requirement varied from 2/-3/ cu m/ns, the magnets requirement varied from 41-53 cu m/hs at the head formation and flowering stages. In case of dryness the soil freed from the predecessor crop should be wetted at the rate of 1000-1100 cu m/hs in order to secure its good preparation. In such a case, timely and regular emergence of the post-stubble crops may be secured by spray irrigation immediately after planting at the rate of 300 cu m/ha. Maize as catch crop leaves in the soil, 10,000-13,000 kg/ha air dry organic debris and the sunflower from art dry Organic deoris and the sunitower from \$170-6810 kg/ha, thus improving the content of or-ganic substances of the soil.—Copyright 1972, Biological Abstracts, Inc. W73-02670.

CONTRIBUTION TO THE STUDY OF THE POSSIBILITIES OF INTRODUCING
PYRETHRUM CINERARIAEFOLIUM TREV. IN SERVIA AND VOYVODINA: SECOND RE-

PORT, Belgrad Univ. (Yugoslavia). R. Ivanic, and J. Tucakov.

R. Ivanuc, and J. Tucakov.

Glas Srp Akad Nauka Umet Od Med Nauka. Vol

279, No 23, p 37-49, 1971. Illus.

Identifiers: Climate, Irrigation, *Pyrethrum
cinerariaefolium D, Serbia, Soils, Voyvodina,
Crop yield, *Yugoslavia.

The possibility of introducing P. cinerariaefolium was investigated at 9 different sites, each with a different climate, soil, altitude, and exposure. Each site contained 400 plants. This plant was Each site contained 400 plants. This plant was found suitable for cultivation in Serbia and Voyvodina under continental climate conditions. It was resistant to the low winter temperature (-28.SC at Kladovo). The flower-head yield was 6-12% higher than the control at Dubrovnik on the Adriatic. The most profitable yield was at Kladovo in spite of the poorer soil, climate, and exposure conditions. Considerable oscillations in humidity and especially a cold, humid summer had a negative influence, causing a decrease in the flower tive influence, causing a decrease in the flower yield. In cases of long dry spells in the summer, irrigation is a necessity especially on porous soils (dunes, moving sands of Deliblato, pebbly terrain of Kladovo, etc.). The average yield was 26.5 kg of dry floral heads/acre. (See also W73-02672)—Copyright 1972, Biological Abstracts, Inc. W73-02672

CONTRIBUTION TO THE STUDY OF THE POSSIBILITIES OF INTRODUCING DALMATIAN PYRETHRUM (PYRETHRUM

CINERARIAEFOLIUM TREV.) IN SERBIA AND VOYVODINA: 3RD REPORT. THE INFLUENCE OF GROWING SITE ON THE PERCENTAGE

OF PYRETHRINE S, Belgrad Univ. (Yugoslavia). R. Ivanic, and J. Tucakov.

Glas Srp Akad Nauka Umet Od Med Nauka, Vol.

279, No 23 p 139-146. 1971. Illus.
Identifiers: *Plant growth, Humidity, Insecticides, Pyrethrins, *Pyrethrum cinerariaefolium D, Pyrethrum D, Serbia, Sites, Temperature, Voyvodina, Winter, *Yugoslavia.

Several years of experimentation on the transplantation of P. cinerariaefolium from the Adriatic coast to Serbia and Vojvodina in continental Yugoslavia were conducted in different areas with different soils and climates. This xerophilous spe-cies was resistant to long dry spells and able to withstand the severe winters of Serbia and Vojwinstand the severe winters of Seroia and voj-vodina. However, it was very sensitive to humidi-ty. Porous, permeable, sandy soil on a hillside where rainwater runs off easily is preferred by this plant. Heavy, clayey soils with an impermeable subsoil are unfavorable for its growth. This species, although xerophilous, was unfavorably af-fected by the long dry winds coming from the east and southeast, especially during budding. Floral heads were collected from plants with half-open flowers, the stage at which pyrethrine values are highest, and were tested for their pyrethrine content by the Seil method. The percentages of pyrethrine present in plants grown in Serbia, Voj-vodina, and in Dubrovnik (Adriatic coast) were practically the same; the difference between different sites during 3 yr of experimentation were minimal. The pyrethrum of Zajecar (Serbia) contained 1.3-1.6 times more pyrethrine I than pyrethrine II. In all the test fields, the lower temperatures of winter and a thick covering of snow were more favorable and caused an increase in the percentage of pyrethrines in the pyrethrum flowers. (See also W73-02671)—Copyright 1972, Biological Abstracts, Inc. W73-02672

GERMINATION BEHAVIOUR OF A WEED AND THREE RELATED CROP PLANTS UNDER VARIOUS CONDITIONS OF SOIL WATER CONTENT AND TEMPERATURE.

S. P. Shukla. J Indian Bot Soc. Vol 50, No 3, p 272-276. 1972. Identifiers: *Weed control, Soil water, Brinjal D, Chilli D, Crops, Fenugreek D, *Germination, Plants, *Portulaca oleracea D, Soil, Temperature, Weeds.

Germination-behaviour of a common weed. Portu-laca oleracea, and 3 related crop plants was studied. Different types of temperature and soil water conditions were used in germination. Seeds of the weed and fenugreek germinate over wide range of temperature but other crop plants, i.e., chilli and brinjal, can do so over a limited range. All 4 spe-cies need more than 30% water for their germination. Weedseeds, however, become germinable even before summer. Thus, it is possible to allow the seeds to germinate and eradicate them before the field is prepared for rainy season crops.— Copyright 1972, Biological Abstracts, Inc. W73-02673

PEPPER YIELD AS AFFECTED BY HYDROMETEOROLOGICAL FACTORS (IN

RUSSIAN), N. I. Sinitsina, L. E. Bozhko, and V. A.

Tyuleneva. Meteorol Klimatol Gidrol Mezhved Nauchn Sb. 6.

p 156-159, 1970. English summary. Identifiers: Irrigation, Meteorological conditions, *Pepper D. *Precipitation (Atmospheric), Tem-perature, USSR, Crop yield, *Ukraine.

The effects of temperature and water supply on pepper yields were studied. Pepper yields in the forest-steppe zone of the Ukraine are conditioned by air temperature and amount of precipitation during the vegetative period, and in the steppe zone by air temperature and amount and rates of irrigation.—Copyright 1972, Biological Abstracts,

W73-02674

PLASTIC COVERING AND IRRIGATION OF EARLY POTATOES, E. Hejlesen, K. Knudsen, K. Hardy, and V.

Tidsskr Planteavl. Vol 75, No 6, p 774-787, 1971. Ildus. English summary.
Identifiers: Irrigation, *Plastic covering (Plants),
*Potatoes D, Temperature.

Potatoes grown for very early lifting should be covered with polyethylene film at the time of planting. Then it must be removed at the proper time to avoid temperature shock. The plants are not exposed to extremely high temperatures by keeping the polyethylene film unperforated in strong sunshine. Weed-killers must be given in small doses to the covered potatoes because of stronger effect in the warmer climate under the small doses to the covered potatoes because of stronger effect in the warmer climate under the film. Sandy soils with low water capacity requires 25 mm irrigation at deficit 20 mm, measured from emergence of the potatoes.—Copyright 1972, Biological Abstracts, Inc. W73-02675

BIOLOGY OF THE BLOOMING OF ZIZYPHUS JUJUBA MILL (IN RUSSIAN),

E. M. Erkkenova.

Biol Nauk. Vol 14, No 9, p 51-55. 1971. Illus. Identifiers: *Blooming (Plants), Humidity, Tem-perature, Weather, *Zizyphus jujuba D, USSR.

Massive flowering began 9-10 days after the blooming of the first flower and continued for 27-30 days. The time of initial blooming depended on the weather conditions, especially temperature and atmospheric humidity. Blooming was late under unfavorable conditions and blossoms did unavorance conditions and blossoms did not open during rain. Not more than 10% of the blossoms produced fruit.—Copyright 1972, Biolog-ical Abstracts, Inc. W73-02676

CHERRY YIELDS AS CONDITIONED BY SOIL MOISTURE (IN RUSSIAN),

A. M. Vukolova.

Sadovod Vinograd Vinodel Mold. 6. p 7-9. 1970. Identifiers: *Cherry D, *Soil moisture, *Cropyield, USSR.

In 1966, the year with a rainfall of 603 mm, the yield was heavy (102 kg/tree); in the dry year of 1963 (344 mm), the yield was half that amount. However, no consistent correlation could be established. Coefficient of variation was +0.89, with theoretical coefficient at 0.05-0.81. Rainfall with incorrected coefficient at 0.03-0.81. Rammai approaching 300 mm on soils with a high water table, and 350 on lighter soils, insures an average yield of 20-25 t/ha.—Copyright 1972, Biological Abstracts, Inc.

THE EFFECT OF DROUGHT ON POTATO YIELDS IN THE UKRAINIAN SSR (IN RUS-

V. A. Kapelyush.
Meteorol Klimatol Gidrol Mezhved Nauchn Sb. 6. p 152-155. 1970. English summary. Identifiers: *Drought, *Potato D, *Ukrainian SSR, Crop yields.

A constant adopted for assessment of drought dur-ing the period of tuber formation was a hydrother-mic coefficient not exceeding 0.6, for which yield

Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F-Conservation in Agriculture

reduction below the longterm average was recorded. Drought distribution limits were determined for the territory studied, in relation to spring and summer planting.—Copyright 1972, Biological Abstracts, Inc.

A PHYSIOLOGICAL STUDY ON VARIATIONS OF DRY MATTER PERCENT OF TUBER IN SWEET POTATOES (IN JAPANESE), Osaka Univ. Uapan). Dept. of Biology.

G. I. Hirai.

G.I. Hirai.
Mem Osaka Kyoiku Univ Nat Sci Appl Sci. Vol 17
No 2, p 33-92. 1968. Illus. English summary.
Identifiers: Absorption, Environmental effects,
"Phosphorylase activity, Physiological studies,
"Sweet potatoes D, "Transpiration, "Tuber.

The percent of dry matter in sweet potato tubers shows considerable fluctuations according to the environmental conditions of the plant, as well as among cultivars. The water economy balance of the plant is primarily involved in the origin of the difference of the dry matter percent of tuber caused either by environmental or by genetic factors. Phosphorylase activity was measured. caused either by environmental or by genetic factors. Phosphorylase activity was measured because of its important role in starch metabolism. Phosphorylase activity was highest when the water absorption was approximately equal to transpiration. When absorption exceeded transpiration, the enzyme activity lowered. When transpiration exceeded absorption, the phosphorylase activity again decreased. A positive correlation was found between phosphorylase activity and the dry matter percent of tuber in sweet potatoes. The water economy balance seems to control the translocation of the assimilation products from the top to the tuber and also starch synthesis in the tuber, and therefore, it brings about variations of the dry and therefore, it brings about variations of the dry matter percent of the tuber.—Copyright 1972, Biological Abstracts, Inc.

THE EFFECTS OF WATER AVAILABILITY ON TEA YIELDS IN UGANDA, Newcastle-upon-Tyne Univ. (England). Dept. of

J Appl Ecol. Vol 8, No 3, p 791-813. 1971. Identifiers: Growth, Soils, *Tea D, *Uganda, Water availability, Crop yield, *Soil-water index.

Monthly averages of tea yields for estates in Ugan-da were correlated with soil water indices. In calda were correlated with soil water indices. In cal-culating averages of yields the effects of dif-ferences in site and soil, growth cycles, maturity and in particular the recovery from pruning were reduced as far as possible.—Copyright 1972, Biological Abstracts, Inc.

EFFECTS OF SUMMER APPLICATION OF WATER AND NITROGEN ON FRUIT QUALITY AND FLOWERING OF SATSUMA ORANGE TREES (IN JAPANESE), Wakayama Fruit Tree Experiment Station (Japan). E Tomita

E. Tomita. J Jap Soc Hortic Sci. Vol 40, No 3, p 225-229. 1971.

Identifiers: Fruit, Growth, *Nitrogen, *Orange D, *Satsuma orange trees, *Soil moisture, Summer,

The effects of 3 levels of soil moisture (pF 2.3, 3.0, 4.0) and 2 of N (0 or 18 g/pot) were examined. Soil moisture kept at pF 3.0 in summer was optimum for family and the state of the st for fruit growth and quality. At pF 4.0, fruit weight became extremely smaller and coloring of fruits was retarded. At pF 2.3, soluble solids and total sugar contents in fruit juice decreased. When N was applied in summer, fruit weight slightly in-creased, but soluble solids and total sugar contents in fruit juice were lowered and coloring of fruits was retarded. Although the number of flowers in the following spring increased with decreasing soil moisture, the growth of new shoots was checked; when N was applied, the growth of new shoots and the number of flowers improved.—Copyright 1972, Biological Abstracts, Inc.

EFFECTS OF IRRIGATION METHODS ON GROWTH OF MANGO (MANGIFERA INDICA

GROWTH OF MARKOO (MARKO)
L.) PLANTS,
Horticultural Research Inst., Saharanpur (India).
A. Prasad, and A. R. Singh.
Hortic Sci. vol 2, No 1, p 33-38, 1970. Illus.
Identifiers: Growth, *Irrigation (Ring method),
Mangifera indica D, *Mango D, USSR.

The ring method of irrigation was observed to be the most effective for the diameter growth of the stock and scion, and height of the plant. Flooding, however, could induce maximum spread followed by the ring method. The use of the sprinkler showed the poorest response in plant vigor. The plants needed more frequent irrigation in summer than in winter.—Copyright 1972, Biological Ab-stracts. Inc. stracts, Inc. W73-02698

THE RESPONSE OF GOOSEBERRIES TO NON--TILLAGE SYSTEMS OF MANAGEMENT, D. J. Allott, D. W. Robinson, and S. D. Uprichard.

Hortic Res. Vol 11, No 3, p 166-176, 1971. Identifiers: Erosion, *Gooseberries D, Growth, Management, Manure, Nontillage, *Roots, *Soil erosion, Sphaerotheca mors uvae, Weed control.

Where weed control was achieved by herbicides, gooseberries (cv. 'Careless') were grown satisfactorily without any form of post-planting soil cultivation. In some cases crop yields were increased by eliminating traditional cultivations. Such cultivations, particularly in the close proximity of the bushes, were considered to be relatively damaging to growth and yield due to their harmful effects on good development. Soil encoion was shown to be to growth and yield due to their nammul errects on root development. Soil erosion was shown to be most pronounced where there was no soil cultiva-tion; but it was successfully prevented, as wa-water run-off; by annual applications of farmyard manure between the bush rows. Detrimental ef-fects of surface soil erosion were not evident in fects of surface soil erosion were not evident in the experiments reported, but it is considered that such erosion could be an important factor on long steep slopes. Stooled bushes grew more vigorously than those on a traditional leg and gave the highest over-all yield. Stooled bushes tended to produce a large number of relatively small berries and were more prone to infection by American gooseberry mildew (Sphaerotheca mors-uvae).—Copyright 1972, Biological Abstracts, Inc.

W73-02699

THE INFLUENCE OF MIST IRRIGATION ON THE POTATO I. MICRO-ENVIRONMENT AND LEAF WATER RELATIONS, Minnesota Univ., St. Paul. Dept. of Horticultural

Science.
D. C. Sanders, and R. E. Nylund.
American Potato Journal, April 1972. Vol 49, No
4, p 123-137, 15 p, 8 fig, 2 tab, 17 ref. OWRR B013-MINN (2), 14-01-0001-1915.

Descriptors: *Mist irrigation, *Potato, *Transpira-tion, Temperature, Soil moisture, Photosynthesis, Crop production, *Stomata. Identifiers: *Tugor, *Internal moisture stress.

The influence of low gallonage 'mist' irrigation on The influence of low gailonage mist irrigation on the following parameters were measured: leaf, air and soil temperature, and soil moisture, relative turgor and stomatal aperature. Misted canopies had lower leaf, air and soil temperature and higher soil moisture than the non-irrigated plants. Stomata of misted plants did not close as rapidly as those of non-irrigated plants. Mist irrigation reduces internal moisture stresses in plant leaves. reduces internal moisture stresses in plant leaves.

Because such internal stresses limit photosynthesis, misting keeps plants more active photosynthetically. Further work is needed to determine the most effective rate and frequency of water application. If water rates can be reduced then perhaps misting may offer a means of water conservation or at least increase crop production per unit of water used. (See also W73-02441, W73-02442, and W73-01968) (Walton-Minnesota) W73-02888

AN ECONOMIC ANALYSIS OF WATER-USE REGULATION IN THE CENTRAL OGALLALA

PORMATION,
Oklahoma State Univ., Stillwater. Dept. of
Agricultural Economics.
For primary bibliographic entry see Field 04B.
W73-02892

RADIAL OXYGEN LOSSES FROM INTACT RICE ROOTS AS AFFECTED BY DISTANCE FROM THE APEX, RESPIRATION AND WATERLOGGING, Hull Univ. (England). Dept. of Botany.

Null Univ. (England). Dept. of Bolany.
W. Armstrong.
Physiol Plant. Vol 25, No 2, p 192-197. 1971. Illus.
Identifiers: Apex. Cortex. Electrodes, Lacunae,
*Oxygen losses (Plants), Pericycle, Permeability,
Platinum, Porosity, Respiration, *Rice-M, *Roots,
Soil, Waterlogging.

Radial oxygen losses (ROL) from the roots of in-tact rice plants were assayed by the cylindrical Pt electrode technique. At 23 C losses from roots grown in waterlogged soil proved to be about dou-ble those from non-waterlogged plants. Cooling led to increased ROL, and it was estimated that at 23 C respiratory activity had been reducing oxygen loss by 8-10 x 10-8 g O2 cm-2 root surface min-1 (ca. 50%) in the non-waterlogged, and by 4.5-5.5x10-8 g O2 cm-2 min-1 (20-30%) in the waterlogged roots. Lucunae formation occurred nearer to the apex and was eventually more extensive in the waterlogged roots while the presence of more intact and presumably functional tissue in the nonintact and presumably functional tissue in the non-waterlogged roots coincides with the greater respiratory effect noted. Estimated flux rates at 23 C (respiration inactive) were, respectively, 15-17 x 10-8 g O2 cm-2 min-1 (non-waterlogged) and 20-23 x 10-8 g O2 cm-2 min-1 (waterlogged). A major part of this difference probably can be accounted by the differences in root porosity, and 'leakiness' superimposed upon lower porosity in the non-waterlogged plants may account for the remainder. ROL also was examined in relation to distance from the anex. With respiratory activity lowered by coolapex. With respiratory activity lowered by cooling, 2 patterns of oxygen loss were detected. Pating, 2 patterns of oxygen loss were detected. Pat-tern I was a property of younger roots of length between 5-9 cm, while pattern 2 was found in longer roots, 11-16 cm. bearing numerous emer-gent laterals. In both, ROL fell rapidly towards the base and at 4-5 cm approached zero in pattern I and near zero to about 16% of the maximum in patand near zero to about 16% of the maximum in pat-tern 2. The rapid drop in oxygen loss in both pat-terns, which indicates a concomitant decrease in root wall permeability was associated with the ap-pearance of cortical lacunae at 2-3 cm from the apex. In pattern 2 a rise in ROL began at 5-6 cm from the apex. The presence of lateral root initials in both the pericycle and unbroken segments of cortex was associated with maintained permeabili-ty in this pattern as well as with the basal increase in ROL.—Copyright 1972, Biological Abstracts, Inc. Inc. W73-02930

SCRUBBED DIESEL EXHAUST FOR CARBON DIOXIDE ENRICHMENT OF GREENHOUSE VEGETABLES, Arizona Univ., Tucson. Environmental Research

Lab. H. M. Eisa, V. J. Leggio, and M. H. Jensen. Hortiscience, Vol 6, No 5, p 477-479, October, 1971. 1 tab, 3 fig, 10 ref.

Descriptions of the property o ture, ve

Carbon ble productors. Galso pro was used ble crop and com affected The abse use of ethylene probably compare slowly, a cumber a gas-adde which the recover, tinuing ga W73-030

NUTRIE ENHANC Illinois U G. R. Safi Plant Phy fig, 31 ref

Descripto sistance, *Membra Plant gro Plant phy Plant patitionships, Mycorrhi:

Harosoywater tran 4.5 weeks determine lowered r host broug resistance there wer stems plus of the myo the root chloronitre to water probably i the transpo hizal soyb application resistances with low le the enhance about by levels. (Bla W73-03087

MAN AND Geological R. L. Nace. Bulletin of 34-38, 1972

Descriptors *Drainage managementrol, Planning

A summary of water su Descriptors: "Envrionmental effects, "Greenhouses, "Plant physiology, Limiting factors, "Plant growth regulators, "Inhibitors, "Phytotoxicity, "Air pollution effects, Physiological ecology, Growth chambers, Carbon dioxide, Horticulture, Vegetable crops, Gases, Oxides, Horticultural crops, Environmental control, Metabolism.

tural crops, Environmental control, Metabolism.

Carbon dioxide enrichment in greenhouse vegetable production is a standard practice for some crops. Gas generation is commonly used since it also provides supplemental heat. Diesel exhaust was used for carbon dioxide earichment of vegetable crops in inflated plastic houses. Fuel source and components of the recovery system crucially affected the elimination of other harmful gases. The absence of an activated charcon filter and the use of fuel high in sultur content increased ethylene, sulfur dioxide, nitrogen dioxide, and probably others. In the gas-added environment, as compared with the ambient one lettuce grew more slowly, and leaf size and yield decreased in cucumber and eggplant. Plants were exposed to the gas-added environment for about 5 months, after which the system was discontinued. Plants did not recover, and symptoms continued despite discontinuing gas addition. (Black-Arizona)

NUTRIENT STATUS AND MYCORRHIZAL ENHANCEMENT OF WATER TRANSPORT IN SOYBEAN, Illinois Univ., Urbana. Dept. of Plant Pathology.

G. R. Safir, J. S. Boyer, and J. W. Gerdemann.
Plant Physiology, Vol 49, No 5, p 700-703, 1972. 4
fig, 31 ref.

Descriptors: *Nutrient requirements, *Disease resistance, *Fungi, *Symbiosis, *Metabolism, *Membrane processes, Soybeans, Fungicides, Plant growth, Root development, Phytotoxicity, Plant physiology, Plant morphology, Absorption, Plant pathology, Osmosis, Soil-water-plant relationships, Cytological studies, Infection.

Mycorrhizal soybean (Glycine max L. Merr. Var. Harosoy-63) plants have lower resistances to water transport than nonmycorrhizal plants after 4.5 weeks of growth. This study was undertaken to determine where the fungus acts and whether the lowered resistance to water transport can be attributed to increases in the nutrient status of the host brought about by the mycorrhizae. Although resistances of whole plants differ by 40 percent, there were no differences in the resistances of stems plus leaves, indicating that the major effect of the mycorrhizae was to reduce the resistance of the roots. Since the fungitoxicant, p-chloronitrobenzene, had no effect on resistances to water transport, reduced resistances were probably not caused by a direct modification of the transport pathway by the fungus. Differences in resistance between mycorrhizal and nonmycorrhizal soybean were essentially eliminated by the application of nutrients to the soil. Thus, lowered application of nutrients to the soil. Thus, lowered resistances of mycorrhizal roots growing in soil with low levels of nutrients probably resulted from the enhanced nutrient status of the plant brought about by the fungus. Mycorrhizal infection increased growth at both low and high nutrient levels. (Black-Arizona)

MAN AND WATER: A LESSON IN HISTORY, Geological Survey, Washington, D.C. R. L. Nace.

Bulletin of the Atomic Scientists, Vol 28, No 3, p 34-38, 1972. 2 fig.

Descriptors: *Irrigation systems, *History, *Drainage systems, *Irrigation practices, Water management (Applied), Water supply, Water control, Planning, Social aspects.

A summary is presented of ancient basic problems of water supply, water management, dryfarming,

early irrigation, runoff diversion and collection. Considerable detail is devoted to early irrigation methods of the Sumerians, Iranians, Egyptians, Arabians, and of the Hopi and Hohokam indian cultures of the New World. The earliest irrigation project in North America, the 'chinampa' system of Mexico, involved a giant hydraulic system based on land drainage, intensive agriculture and manipulation of water. Early water systems designed for urban needs are examined. Roman hydraulics, early pollution parallels with moderaday techniques are also discussed. (Black-Arizona) W73-03090

PLASTIC INFLATED ENVIRONMENTAL

GROWTH CHAMBER, Arizona Univ., Tucson. Environmental Research

W. G. Gensler. Transactions of the American Society of Agricultural Engineers, Vol 15, No 2, p 350-351, 354, 1972. 5 fig, 2 ref.

Descriptors: *Greenhouses, *Growth chambers, Temperature control, "Environmental engineering, "Environmental control, "Environmental effects, Agricultural engineering, Structures, Thermal insulation, Plant growth, Quality control.

A portion of the engineering approach employed in the design of the phytocell complex at the Environmental Research Laboratory of the University of Arizona is described. The phytocell utilizes an inflated dome shaped polyethylene film placed over a relatively large growing area. Horizontal airflow passes through the growing area where temperature, wind velocity and CO2 are controlled. Relative humidity, while not directly controlled, is maintained at a high level because of the use of water wash heat exchangers. A general trouted, is maintained at a night level occase of water wash heat exchangers. A general structural layout of the phytocell and a photograph of a particular unit are shown. Wind velocity, performance results, and a few operating problems are discussed. (Black-Arizona) W73-03095

HYDROPHILIC POLYMER AS A SOIL

AMENDMENT, Arizona Univ., Tucson. Environmental Research

For primary bibliographic entry see Field 02G. W73-03098

AN INTEGRATED SYSTEM FOR PROVIDING POWER, WATER AND FOOD FOR DESERT COASTS,

Arizona Univ., Tucson. Environmental Research

C. N. Hodges, and C. O. Hodge. Horticultural Science, Vol 6, No 1, p 10-13, February 1971. 3 fig, 4 tab, 11 ref.

Descriptors: *Greenhouses, *Growth chambers, Peteripiors. "Teennouses, Grown chambers, "Temperature control, Environmental engineering, "Environmental control, Environmental efects, "Desalination, Horticulture, Vegetable crops, Irrigation efficiency, Water conservation, Evaporation control, Transpiration control, Pilot plants, Structures, Plant growth, Arid lands, Agricultural engineering, Thermal insulation. Identifiers: *Abu Dhabi, *Mexico.

Of the 20,000 miles of coastal deserts that gird the earth, most are devoid of population. Several methods which might make these areas more hospitable have been suggested. However, many ese ideas require a prerequisite investment that few less developed nations can afford. An approach has been devised that can economically provide power, water and food for coastal commu nities. Studies at the Environmental Research Laboratory in Tucson, Arizona were originally aimed at devising a new technique to reduce the

cost of desalting sea water. A pilot plant was constructed on the Gulf of California at Puerto Penasco, Sonora, Mexico, in cooperation with the University of Sonora. In this development, the Laboratory realized an energy source, more manageable than solar energy, was going to waster, namely, heat from two diesel engines used for pumping water, powering mechanical equipment, and lighting the station. Heat exchangers were therefore altached to the exhausts and water jackets of the engines. These now provide the heat for a unit which makes 2400 gallions of fresh water daily. It also became apparent that desalted water would remain too expensive for conventional open-field agriculture. This led to an evolution in greenhouse design. Plastic-covered structures are now being used, various vegetable crops are greenhouse design. Plastic-covered structures are now being used, various vegetable crops are grown directly in beach sand. Necessary nutrients are mixed with the desalted irrigation water and just enough is applied to irrigate the root zones. As a result of this research, the University of Arizona received a grant in February of 1969 to design and incomments a large-scale power/water/food facility integrate a grant in February of 1969 to design and integrate a large-scale power/water/food facility for the small Arabian Peninsula Shaikhdom of Abu Dhabi, 500 miles southeast of Kuwait. Full-scale production of a five-acre plant is expected early in 1972. (Black-Arizona)

EFFECT OF LATERAL DEVELOPMENT OF PROSOPIS JULIFLORA DC. ROOTS ON AGRICULTURAL CROPS,

Indian Council of Agricultural Research, Bellary (India). Southern Regional Soil Conservation Research Sub-Station.

thuas. Southern Regional Soil Conservation Research Sub-Station.
M. C. Prajapati, B. Verma, S. P. Mittal, K. T. N.
Nambiar, and B. S. Thippannavar.
Annals of Arid Zone, Vol 10, Nos 2-3, p 186-193, 1971. 3 tab, 1 fig, 1 photo, 13 ref.

Descriptors: "Competition, "Crop response, "Bioindicators, "Inhibitors, "Soil-water-plant relationships, "Root distribution, Root zone, Plant growth, Plant growth regulators, Productivity, Crop production, Root development, Root systems, Control, Cultivation.

Intensity and extent of lateral development of Prosopis juliflora hedge roots in agricultural fields, their concentration in different depth zones and their offects on growth parameters of Sorghum vulgare crops were studied in three replications during 1970. In cultivated fields, the major concen-trations of Prosopis roots were within 0-20 cm evidently favoring soil and moisture conditions from repeated tillage and fertilizer applications for raising crops. Growth of crops along the Prosopis hedge was subnormal. The width of the strip having subnormal crop growth gradually increased as the height of the hedge increased. Growth and yield parameters of the Sorghum crop were in con-formity to its number of roots, and plants closest to the hedge bore no fruits. High competition from prosopis roots do not permit normal growth of the other species in the root affected area. (Black-Arizona) W73-03101

ORGANIZATIONAL ASPECTS OF IRRIGA-

TION SYSTEMS, Colorado State Univ., Fort Collins. Dept. of

Colorado State Univ., Fort Collins. Dept. of Sociology and Anthropology. E. Vlachos, and B. Ellenbogen. Paper presented at Annual Meeting of the Rural Sociological Society, Denver, Colorado, August 1971. 16 p., 3 fig. OWRR B-043-COLO (3).

Descriptors: Social aspects, *Rural sociology, *Non-structural alternatives, Water management, *Decision making, *Competing uses, *Irrigation systems, Analytical techniques, Water resources, Irrigation programs, Social adjustment.

A problematic situation in water management is discussed and an on-going research project dealing

Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F-Conservation in Agriculture

with organizational attempts of consolidating selected public and private irrigation companies in five western states is used as an illustration. An examination of irrigation systems emphasizes a examination of irrigation systems emphasizes a central argument of measuring each possible engineering case of consolidation against non-physical constraints and facilitators affecting long-term goals. Organizational response of agencies and communities also provide important indicators about the ability of a particular irrigation company or system of companies to effectively meet future demands. Organizational effectiveness would then imply the extent to which an irrigation system exhibits a conjective without incapacitating its achieves its objectives without incapacitating its means and resources, and without placing undue strain on its members. The question is whether this is more apt to occur within a consolidated or non-consolidated irrigation system. (See also W73-03107) (Black-Arizona)

ORGANIZATIONAL ALTERNATIVES IN CON-SOLIDATING IRRIGATION SYSTEMS, Colorado State Univ., Fort Collins. Dept. of Sociology and Anthropology. E. Vlachos.

E. Viachos.

Paper presented at the American Society of Civil Engineers, Irrigation and Drainage Division Specialty Conference on Optimization of Irrigation and Drainage Systems, Lincoln, Nebraska, October 6-8, 1971. 25 p, 2 fig. OWRR B-043-COLO

Descriptors: *Non-structural alternatives, Social aspects, Analytical techniques, Methodology, Water management, "Planning, Long term planning, "Water policy, "Water utilization, "Competing uses, "Multiple-purpose projects, Water zoning, Water resources, Legal aspects, Delitical constants." Water Zohing, Water Testurees, Legal aspects, Political aspects, Irrigation practices, Rural sociology, Social adjustment, Decision making, Urban sociology, Economics.

The sociological approach to natural resources, particularly to water resources has been limited to traditional presentations of the role of the environparticularly to water resources has been innited to traditional presentations of the role of the environment in any analysis of a social system with few verified generalizations and with descriptive rather than analytical emphasis. Objectives are to delineate the sociological prespective in the understanding of water developments, especially in the West, and to provide the theoretical and methodological framework for both the design of the sociological investigation and of the interphase between engineering, legal and social factors in any effort of consolidating irrigation systems. The overall study on the consolidation of irrigation systems tries to provide the synthesis for such an integrated approach by focusing on the following major research themes and dimensions: (1) An attempt towards 'interdisciplinary' synthesis by a complex accounting of a host of physical and nonphysical factors which act as either facilitators or constraints towards efforts of consolidation, (2) or constraints towards efforts of consolidation, (2) a by-product of the above emphasis is the orienta-tion towards an integrated model of water management systems incorporating aspects of external and internal environments through an Input-System-Output analysis, (3) target areas have been selected as parts of a 'continuum' representing not only cases of consolidated and non-consolidated irrigation systems, but also other important dif irrigation systems, but also other important directions of size, complexity, and socio-economic characteristics, (4) the present study has the additional advantage of involving both macro- and micro-level considerations. (See also W73-03106) (Black-Arizona)

VEGETABLE PRODUCTION UNDER PLASTIC ON THE DESERT SEACOAST OF ABU DHABI, Arid Land Research Center, Abu Dhabi (Trucial Oman). M. R. Fontes, J. O'Toole, and M. H. Jensen.

In: Proceedings, Tenth National Agricultural Plastics Conference, Chicago, Illinois, p 93-102, November 1971. 6 tab, 2 fig, 2 ref.

Descriptors: "Greenhouses, "Growth chambers, Environmental engineering, "Environmental control, Environmental effects, "Plastics, "Vegetable crops, Horticultural crops, Horticulture, Agricultural engineering, Structures, Environment, Temperature control, Thermal insulation, Plant growth, Quality control, Irrigation systems, Irrigation efficiency, Arid lands.

Development of an integrated system for the production of power, water and food began at the Environmental Research Laboratory of the University of Arizona over three years ago. A pilot plant, sponsored by the Rockefeller Foundation, was initiated on the Gulf of California at Puerto Penasco, Sonora, Mexico, in cooperation with the University of Sonora. As the system evolved, test-University of Sonora. As the system evolved, testing on a much larger scale became apparent. The first large-scale power, water, food facility in the world is now located on the Arabian Gulf in the country of Abu Dhabi. Nearly a year of intensive research in plastic greenhouses indicates that high-quality vegetables can be produced in Abu Dhabi at yields far greater than ever realized. Plastic liners under the growing beds, and the controlled placement of irrigation water through 'trickle' irrigation systems, aid in conserving the amount of desalted water used to grow the crops. Such an desalted water used to grow the crops. Such an agricultural system is capable of supplying high quality foods in quantities needed for the expanding population of the world. (Black-Arizona) ing populati W73-03110

AN EFFECT OF WATER STRESS ON ETHYLENE PRODUCTION BY INTACT COTTON PETIOLES,

Texas A and M Univ., College Station. Dept. of

Plant Sciences.

B. L. McMichael, W. R. Jordan, and R. D. Powell.
Plant Physiology, Vol 49, No 4, p 658-660, 1972. 1
tab, 2 fig. 18 ref.

Descriptors: *Moisture stress, Plant growth substances, *Plant growth regulators, *Plant physiology, *Metabolism, Plant growth, *Gas chromatography, Moisture deficit, Drought tolerance, Wilting, Biochemistry, Chemical analysis, Organic compounds, *Cotton.

The concept that ethylene is an endogenous growth regulator has evolved in the last few years. This concept has been strengthened by recent findings that internal concentrations of endogenous ethylene in vegetative tissues reach physiologically active levels. The effect of a brief period of water deficit on ethylene production by ntact cotton petioles is described. As severe water intact cotton petioles is described. As severe water deficit developed, sharp increases in ethylene production rates of all petioles resulted. Contrary to the case for well watered plants, production rates of the older petioles exceeded those of the uppermost, younger petioles. Ethylene production rates fell rapidly after the internal water deficit was relieved by watering. Data suggest that the level of ethylene production may not be the controlling factor in leaf abscission, presuming it exceeds some minimum critical level, but that the physiological state of each leaf governs the response to increased endogenous ethylene production. (Black-Arizona)

PATTERNS OF WATER UPTAKE AND ROOT DISTRIBUTION OF SOYBEANS (GLYCINE MAX.) IN THE PRESENCE OF A WATER TA-

Agricultural Research Service, Urbana, Ill. Soil and Water Conservation Research Div. D. C. Reicosky, R. J. Millington, A. Klute, and D.

Agronomy Journal, Vol 64, No 3, p 292-297, May-June 1972. 7 fig. 2 tab, 13 ref.

Descriptors: "Moisture uptake, Root systems, "Root distribution, "Absorption, Soil-water-plant relationships, "Capillary fringe, "Soil water movement, "Hydraulic conductivity, Water table, Crop production, Movement, Soil water, Soils, Limiting factors, Plant growth, Plant physiology, Plant morphology, Soil science, Soil tests, Fringe water, "Soybeans.

The increasing importance of water use in crop production has demonstrated the need for integrated studies of water transport phenomena in the soil-plant-atmosphere system. A better understanding of the basic principles involved can lead to better management techniques for efficient tead to better management techniques for efficient water use. The purpose was to measure water up-take patterns of soybeans and relate these to root distribution and water uptake per unit root length. Water uptake in soil columns was analyzed using the flow equations for water movement in the soil, treating the root system as a macroscopic sink. Results indicate that in the presence of a water table, water uptake was not necessarily related to root distribution and that a small amount of roots near the capillary fringe absorbed most of the water. Results also showed the combined importance and interaction of the hydraulic conduc-tivity and the root distribution in determining the magnitude and the distribution of the sink term. Both of these factors limited the rate of uptake. As boun of these factors limited the rate of uptake. As the plants grew, both increased water uptake per unit root length and increase in the length of roots contributed to meeting the rising daily rate of water use. (Black-Arizona) W73-03114

A METHODOLOGY FOR ESTIMATING THE BENEFITS TO IRRIGATED AGRICULTURE FROM INCREASED ACCURACY IN SEASONAL STREAMFLOW FORECASTS,

Michigan Univ., Ann Arbor. J. L. Moore. Ph D dissertation, 1972. 326 p, 44 tab, 9 fig, 70 ref. OWRR-C-1140 (No. 1588) (1).

Descriptors: *Methodology, *Probability, *Benefits, *Forecasting, *Streamflow forecasting, Economic justification, Non-structural alternatives Timing 1971 Economic justification, Non-structural alterna-tives, Timing, *Linear programming, Computer models, Economic feasibility, Water supply development, Water resources, Water demand, Ir-rigation efficiency, Consumptive use, Non-con-sumptive use, Water supply, Cost-benefit ratio, Decision making, Water rights, Reservoirs, Wells, Data collections, Costs.

The main focus is the economic implications of incremental improvements in water supply forecast, in terms of their value to irrigated western agriculture. A primary purpose was to explore the poten-tials of more efficient utilization of water resources. Growing demands for consumptive and resources. Or the structural measures for mon-consumptive use of western water resources, coupled with the increasing cost of large-scale structural measures, have increased the feasibility of alternate methods of securing benefits from existing distributions and timing of water supplies. Increased accuracy in the forecasts of water supply can help water users adapt their operations more closely to variable conditions while still maintaining economically viable enterprises. The scope is confined to development and testing of a methodology for evaluating the impact of im-proved forecasts on a small agricultural region. While the results generated by this approach are not specifically applicable to any given area, they are suggestive of the nature of the net benefits to irrigators that may result from improved forecasts. In this sense, the research may serve as a guide in evaluating the benefits of improved forecasts to water users. (Black-Arizona) BIOLOGIC -PRODUC TY OF TH Z. V. Moro S-Kh Biol. Identifiers tion, Pas (Cows).

with tall gr without irr with irrigat ash, fat, Ca protein di concentrate Such grass and provid 1972, Biolo W73-03180

EFFECT O PRESSANT WATER V GRAPEVI Hebrew U Agriculture For primary W73-03192

EFFECTS IN TOBAC Stirling U Science. A. J. Redsh J Exp Bot. Identifiers: is, *Stomati

An attempt portance of under cond and liquid-p determined similation a concentration The results (stomata) co in the rate of stress. Exp through the results and discussed in 1972, Biolog W73-03193

RESIDUE R For primary W73-03197

STUDIES O ALFALFA (I Kin-Ichi Nis Sci Rep Fac 24, 1971, Illu tion effects, physiology, l

A field expeto study the yield and chyield of mornificantly highlighted and u

WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 03

Conservation in Agriculture—Group 3F

BIOLOGICAL BACKGROUND OF HIGH-PRODUCTIVE PASTURES AND THE QUALITY OF THE FEED (IN RUSSIAN),

Z. V. Morozova. S. Kh Biol. Vol 6, No 4, p 560-566. 1971. English

Identifiers: Biological studies, *Grass-M, Irriga-tion, Pastures, Productivity (Grass), *Feed (Cows).

In regions of sufficient humidity pastures sown with tall grasses produce above 6000 fodder units without irrigation and up to 10,000 fodder units/ha with irrigation. Grass from such pastures is rich in protein. It is close to the optimal content of gluten, ash, fat, Ca but it is short of P. The coefficients of ash, i.a., Ca but it is short of P. The coefficients of protein digestibility average 75-75%. The milk productivity during the grazing season without concentrate supplements reaches 16.8 kg/day cow. Such grass favorably affects the animals' health and provides cheap, high-quality milk.—Copyright 1972, Biological Abstracts, Inc. W73-03180

EFFECT OF SEVERAL TRANSPIRATION SUP-PRESSANTS ON CARBON DIOXIDE AND WATER VAPOR EXCHANGE OF CITRUS AND GRAPEVINE LEAVES, Hebrew Univ., Jerusalem (Israel). Faculty of

Agriculture.
For primary bibliographic entry see Field 02D.
W73-03192

EFFECTS OF WATER STRESS ON THE RE-SISTANCE TO UPTAKE OF CARBON DIOXIDE IN TOBACCO, Stirling Univ. (Scotland). Dept. of Industrial

A. J. Redshaw, and H. Meidner.

A.J. Redshaw, and H. Medner. J Exp Bot. Vol 23, No 74, p 229-240. 1972. Illus. Identifiers: "Carbon dioxide, Leaf, Photosynthesis, "Stomata, "Tobacco-D, Transpiration, Uptake, Water stress.

An attempt was made to determine the relative importance of the stomata in restricting CO2 uptake under conditions of water stress. The air-phase and liquid-phase resistance to uptake of CO2 were determined from measurements of the rates of assimilation and transpiration and the corresponding concentration gradients of CO2 and H2O vapor. The results showed that the air-phase resistances (stomata) could account for only half the reduction in the rate of photosynthesis accompanying water stress. Experiments in which air was passed through the leaf confirmed that water stress restricted CO2 fixation within the leaf itself. The results and their possible explanation are discussed in relation to other work.--Copyright 1972, Biological Abstracts, Inc. W73-03193

RESIDUE REVIEWS, VOL. 33. For primary bibliographic entry see Field 05G. W73-03197

STUDIES ON THE PHYSIOLOGICAL NATURE OF ALFALFA PLANTS: 9. EFFECT OF SOIL MOISTURE ON THE SUMMER GROWTH OF

Kin-Ichi Nishikawa Sci Rep Fac Agric Kobe Univ, Vol 9, No 1/2, p 20-

24, 1971, Illus, English summary. Identifiers: *Alfalfa, *Crop production, *Irriga-tion effects, Plant growth, Soil moisture, Plant physiology, Plants, Soils, Summer.

A field experiment was conducted in the summer A neu experiment was conducted in the summer to study the effect of soil moisture on growth, yield and chemical composition of afalfa. The yield of more-frequently irrigated alfalfa was significantly higher than of alfalfa under medium irrigated. rigated and unirrigated plots, mainly because of in-creased tillering and plant height. In proportion to

the lack of soil moisture, the absorption of N, P, K the lack of soil moisture, the absorption of N, P, K and carbohydrate contents in the plant decreased. The effect of irrigation on alfalfa was high in the summer. About 6 mm per day irrigation in midsummer is an adequate amount of water for alfalfa.—Copyright 1972, Biological Abstracts, Inc. W73-03200

PERFORMANCE OF RAINFED AMERICAN COTTON (GOSSYPIUM HIRSUTUM L.) UNDER THREE SOWING TIMES, THREE ROW

THREE SOWING TIMES, THREE ROW SPACINGS AND THREE NITROGEN LEVELS IN NIMAR TRACT OF MADHYA PRADESH, College of Agriculture, Indore (India). Chokhey Singh, and M. S. Khan.
Jakvv (Jawaharlal Nehru Krishi Vishwa Vidyalaya) Res J, Vol 5, No 1, p 9-13, 1971.
Identifiers: "Crop production, "Cotton, "India, Madhya Pradesh, Nimar, Nitrogen, Rainfed, Rows, Sowing, Spacings, Times, Tract.

Maximum yield of cotton was obtained when the crop was sown in dry soil I wk before the onset of monsoon. Sowing with the onset of monsoon and I wk after it gave comparatively lower yields. The dry sowing of cotton encouraged better growth and fruiting. Forty-five cm row spacing gave the highest yield, though comparatively better growth and more fruiting was obtained at 60 cm row spacing. A significant increase in cotton yield was obtained with 30 and 60 kg N/ha. Higher responses of N was obtained in dry sown crop and 45 cm row spacing. The delay in sowing reduced the response of N.—Copyright 1972, Biological Abstracts, Inc. W73-03201

THE POSSIBILITIES FOR THEIR AGRICUL-TURAL UTILIZATION (IN RUSSIAN), For primary bibliographic entry see Field 02G. W73-03209

SOILS OF NORTHERN TURKMENISTAN AND SOME OF THEIR AGRICULTURAL FEATURES

(IN RUSSIAN),
For primary bibliographic entry see Field 02G.
W73-03210

COMPARATIVE CHARACTERISTICS OF OLD--IRRIGATED SIEROZEMS IN THE VAKHSH VALLEY WITH COMPACTED AND UNCOM-PACTED SUBARABLE HORIZONS (IN RUS-SIAN), V. V. Cherbar'.

Tr Tadzh Nauchno-Issled Inst Pochvoved, Vol 13,

No 2, p75-88, 1970. Identifiers: "Soil physical properties, "Irrigation effects, Morphology, Sierozems, USSR, Vakhsh Valley, Cultivation.

Light-colored, old-irrigated sierozems, with compacted subarable horizons on uncompacted clayey deposits possess poorer physical and textural prodeposits possess poorer physical and textural pro-perties than sierozems on light-loamy and medi-um-loamy deposits. They resemble solonetsous soils in their morphological properties. The com-pacted subarable horizons of clayey sierozems have very low aeration porosity at limiting held capacity, small reserves of available moisture, and capacity, small reserves of avauatie moisture, and very high permeability. Compacted horizons diminish water permeability. The profile of clayey sierozems with compacted horizon is more desalinated than that of light- and medium-loamy sierozems without a compacted horizon. No exchangeable Na was detected. The formation of cted horizons is related to the disaggregatcompacted nonzons is related to the disaggregating effect of irrigation water and tilling implements and settling in the upper portion of profile due to the frequent alternation of wetting and drying. The effect of deep plowing on the physical properties of the soils is discussed.—Copyright 1972, Biological Abstracts, Inc. W73-03215

DEVELOPMENT OF WATER RESOURCES OF A BASIN TAKING ECONOMIC ASPECTS INTO ACCOUNT: PECULIARITIES OF INVESTIGA-TION OF PRACTICAL IRRIGATION TION OF PRACTICAL IRRIGA' PROBLEMS, Institut Gidrodinamiki, Novosibirsk (USSR).

Institut Gidrodinamiki, Novosibirak (USSR).
V. G. Pryazhinskaya.
In: Proceedings of 14th Congress of International
Association for Hydraulic Research, Hydraulic
Research and its Impact on the Environment, Vol
5, p 221-224, 29 August-3 September 1970. 4 p, 1

Descriptors: *Basins, *Water resources development, "Economics, "Irrigation systems, Optimiza-tion, Linear programming, Mathematical models, Profit.

The author reviews his work in the field of the utilization of linear models for the purpose of exploring technical-economical problems in substantiating the economic effectiveness of irrigation systems. The economic-mathematical models under consideration include several annual results under consideration include several annual results of natural moistening and surface runoff. The study provided an investigation of complex problems of agricultural development on both ir-rigated and non-irrigated areas to find the most efreceive combinations of various cultures, to op-timize the structure of cattle-breeding branches and to choose the most effective methods of irriga-tion. The objective function of the problem was the mathematical expectation of profit. (Veverka-Cornell W73-03226

OPTIMUM USE OF WATER RESOURCES OF

BASINS IN IRRIGATION, Tsentralnyi Ekonomiko-Matematicheskii Institut,

Moscow. B. S. Verkhovskii.

In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 237-240, 29 August-3 September 1970. 4 p, 1

Descriptors: *Basins, *Irrigation efficiency, *Irrigation water, *Water resources, Optimization, Economic efficiency, Stochastic processes, Mathematical models, Land resources.

In the hierarchy of the systems of optimum functioning of the economy, the system of the op-timum use of water resources in irrigation (OUWRI) was a subsystem of the complex of op-timum use of water resources (COUWR). On the other hand, OUWRI, in turn comprised of a range of subsystems (water supply, land tillage, etc.). COUWR and OUWRI operated in a stochastically varying environment (water consumption, precipitation, and bioclimatic factors). The requirements of these systems were not always rigidly determined for the entire period of operarigidly determined for the entire period of opera-tion. Thus, one controlled these systems using in-struction programs rather than scheduling pro-grams. This paper was confined to a few general aspects of OUWRI optimization: analysis of the input data, mathematical modelling taking into ac-count the stochastic features, the optimization algorithm, and estimates of water and land resources. (Veverka-Cornell) W73-03229

RISK PROGRAMMING: AN AID IN PLANNING RESERVOIR-IRRIGATION SYSTEMS,

Florida Univ., Gainesville.
J. R. Conner, R. J. Freund, and M. R. Godwin. American Journal of Agricultural Economics, Vol 54, No 2, p 249-254, May 1972. 3 tab, 18 ref.

Descriptors: *Risks, *Planniag, Reservoirs, Crop production, Irrigation, Decision making, Op-timization, Computer models, Water resources development, Forecasting, Agricultural economics, Farm management, Irrigated land,

Field 03-WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F-Conservation in Agriculture

Bibliographies, Planting management, Crops, Irrigation practices, Water users, Water management (Applied), Income.

rigation practices, water theres, water management (Applied), Income.

Identifiers: "Reservoir capacity, Water availability, Water demand mathematical models, Computer-based systems.

Risk programming and simulation are used in a computer model for studying the effects of the variability of irrigation water on farmers' managerial decisions. An example divides a 20,000-acre irrigation district into 60 farms of 333 acres. The acreage can be used for raising cotton, sorghum, oats, and alfalfa, under different irrigation modes. Design variables used in the model to change the amount of water available for crop production are: (1) number of acres planned for irrigation, (2) amount of water, including rainfall, planned for each irrigated acre, and (3) reservoir capacity. The farmers' degree of risk aversion was also a variable and determined the farmers' reactions to varying water deliveries. The model consists of 2 sets of simulations: First, an estimate of the means and variances of crop revenues are determined and used for the farmers' selections are used to determine the actual annual returns. Concluded is that sensitivity to risk should be considered in evaluating potential agricultural income. (USBR)

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

EFFECTS OF RESERVOIR OPERATING POL-ICY ON RECREATION BENEFITS, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. For primary bibliographic entry see Field 06B. W73-02618

WATER RESEARCH AT THE UNIVERSITY OF CONNECTICUT.

Connecticut Univ., Storrs. Inst. of Water Resources. For primary bibliographic entry see Field 09A.

A LAND-USE CLASSIFICATION SYSTEM FOR USE WITH REMOTE-SENSOR DATA, For primary bibliographic entry see Field 07B.

WATER FOR INDUSTRIAL DEVELOPMENT IN COPIAH AND SIMPSON COUNTIES, MISSIS-

Geological Survey, Jackson, Miss. For primary bibliographic entry see Field 03E. W73-02651

MODELING DISCHARGE AND CONSERVA-TIVE WATER QUALITY IN THE LOWER KAN-SAS RIVER BASIN,

Kansas Univ., Lawrence. Dept of Civil Engineering.

W. J. O'Brien, P. B. MacRoberts, E. C. Pogge, and R. L. Smith.

Kansas Geological Survey Bulletin 204, Part 3, 1972. 18 p, 17 fig, 6 tab, 10 ref.

Descriptors: *Water quality, *Model studies, *Reservoir operation, *Flow augmentation, *Kansas, Rivers, Forecasting, Mathematical models, Data collections, Computer programs, Correlation

analysis, Water analysis, Chemical analysis, Water quality control, Water utilization. Identifiers: *Kansas River basin.

Daily discharge and water quality predictions can be made for the lower Kansas River basin with a relatively simple mathematical model suitable for use on a high speed digital computer. The model is based primarily on information available from the data acquisition network operated by the United States Geological Survey. The water quantity portion of the model has been tested for hydrologic accuracy by the reconstitution of eight observed discharge records each of 36 days duration. The water quality aspect of the model has been evaluated by comparing observed and predicted concentrations of individual dissolved ions at selected locations in the basin. Potential uses for this type of model include evaluation of proposed reservoir operating policies on downstream water quality, investigation of the effects of irrigated agriculture on surface water resources of a region, and determination of the impact of industrial development on water quality. Limitations and potential improvements to the model are discussed. (Woodard-USGS)

SLOTTED CORRUGATED METAL PIPE DRAINS, California State Div. of Highways. Materials and

Research Dept.
For primary bibliographic entry see Field 08A.
W73-02659

FLOOD PROFILES IN THE UMPQUA RIVER BASIN, OREGON, PART I, Geological Survey, Portland, Oreg. For primary bibliographic entry see Field 07C. W73-02660

SOME EXTENSIONS OF LINEAR SYSTEMS ANALYSIS IN HYDROLOGY, Purdue Univ., Lafayette, Ind. Dept. of Hydraulic

Engineering.
For primary bibliographic entry see Field 02A.
W73-02662

MULTIRESERVOIR ANALYSIS TECHNIQUES IN WATER QUANTITY STUDIES, Saskatchewan-Nelson Basin Board, Regina.

Water Resources Bulletin, American Water Resources Association, Vol 8, No 5, p 871-880, October, 1972. 8 fig, 5 equa, 21 ref.

Descriptors: "Water quantity, "Linear programming, "Dynamic programming, "Simulation analysis, Model studies, Hydrologic data, River basins, "Canada, Storage, Diversion, Reservoirs, Great Lakes, Rocky Mountain region, Hydrothermal studies."

Identifiers: Water resource systems, Multireservoir networks, *Mass curve analysis, Network analysis, *Multireservoir simulation models, *Saskatchewan-Nelson Basin, Great Lakes drainage basin, Rocky Mountain divide, Water availability.

Different types of systems analysis techniques are applied to water quantity studies of multireservoir networks of increasing degrees of complexity. It is shown how each technique can be used, modified, and combined with other techniques to solve specific problems and to indicate the degrees of complexity at which more sophisticated tools should be applied. First, several applications and limitations of linear and dynamic programming are discussed. Second, it is shown that mass curve analysis is useful, can be extended to serve in computing reservoir rules for conventional multireservoir simulation models, and can be applied in conjunction with either historic or generated

sequences of hydrologic input data. Third, extended and limiting features of conventional time-interval-by-time-interval multireservoir simulation models are analyzed. And fourth, a two-model series for problems which defy analysis by more basic tools is described in detail, the first model using network analysis for all space and time arcs simultaneously and providing data for the second general-purpose model using network analysis each time interval. The importance of efficient computer procedures is stressed. Background includes systems analysis of water availability and hydro-thermal power studies carried out by the Saskatchewan-Nelson Basin Board Study. (Bell-Cornell)

FLOOD CONTROL STORAGE ALLOCATIONS BY LINEAR PROGRAMMING, New York State Dept. of Environmental Conser-

New York State Dept. of Environmental Conservation, Albany. Bureau of Water Resources Planning.
C-s, Liu.

Water Resources Bulletin, American Water Resources Association, Vol 8, No 5, p 976-986, October, 1972. 5 fig, 1 tab, 4 ref.

Descriptors: "Flood control, "Reservoir storage, River systems, Lakes, "New York, "Linear programming, Time lag, "Optimization, Flood damage, Transition flow, Water levels, Storms, Constraints, Equations, Mathematical models, Systems analysis, "Water distribution (Applied). Identifiers: "Oswego River basin, Flood control storages, Reservoir storage allocations, Rule curves, "Reservoir regulation, Storage requirements, Conservation uses, Single-purpose analysis, Finger lakes, Seneca River, Barge Canal, Montezuma muck areas, Eric Canal.

Reservoir or lake regulation is conveniently defined by rule curves that specify the ranges of water levels to be maintained in each period. The setting of rule curves requires balancing the flood control storages reserved against the storage requirements for various conservation uses. A linear programming model is developed to perform single-purpose analysis that minimizes flood damages of a multi-lake river system under various initial and input conditions. The model is deterministic and past storms or synthetic flood hydrographs can be used as inputs to the program. A flood control utility measure function is derived from the resulting analysis, and the inclusion of the function in conservation analysis could provide the total functional analysis. The river-system transition function constitutes the basis for the optimization problem and provides the transformation to reduce significantly the size of the problem; it is general, and it describes the river flow transitions involving time-lags of short duration. The model is applied to the Oswego River Basin Study, which examined joint regulation and management of an existing canal-lake-river system on a basin-wide basis. Large-scale systems analysis is simplified and facilitated. (Bell-Cornell)

MODES OF BOG DEVELOPMENT IN THE UKRAINIAN CARPATHIANS (IN RUSSIAN), Akademiya Nauk URSR, Lvov. Inst. of Botany.

T. L. Andriyenko.
Ukr Bot Zh. Vol 28, No 3, p 362-366. 1971. Illus.

UKr Bot Zh. Vol 28, No 3, p 362-366. 1971. Hus. Maps. English summary. Identifiers: Alpine, "Bogs, Carpathians, Forests, Hanging bogs, Horsetails-P, Hypnum, "Kettle bogs, Sedge-M, Slopefoot bogs, Sphagnum, "Ukrainian, USSR.

Four basic groups of bogs were distinguished kettle bogs of the subalpine belt, kettle bogs of the forest belt, hanging and slopefoot bogs. The subalpine kettle bogs are of post-glacial origin and begin their development from formation of floating mats on the surface of lakes in glacial cirques. The forest kettles and hanging b brooks, the changed is slope foot is slope base nutrition, a at first as prevail. The the Carpat group in mistracts, Inc. W73-02693

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A SOUTHI FOREST II A. F. Kiree Izv Vses O 1969. Identifiers: Deserts, *I *Ravines, S

On the terrifarm of the is a ravine ageni platear following a steppe, Co forests, an istence of sof the norr great depth slopes, whabitats.--C Inc. W73-02758

PROBABIL FLOOD-CO

WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Control of Water on the Surface—Group 4A

forest kettle bogs originate as a result of bogging in kettles and pass the stage of a forest bog. The hanging bogs develop in valleys of mountain brooks, thickets of herbs and horsetails are brooks, thickets of herbs and horsetails are changed to Sedge-Hypnum associations. The slopefoot bogs are formed in leveled areas at the slope base and are characterized by poor mineral nutrition, as a result of which horsetail-sphagnum at first and then sedge-sphagnum associations prevail. The bogs of the second group prevail in the Carpathians by area and those of the third group in number.—Copyright 1972, Biological Ab-stracts. Inc. W73-02693

OPERATION OF SERIALLY-OPTIMAL California Univ., Los Angeles. School of En-gineering and Applied Science.

California Water Resources Center Project No. UCAL-WRC-W-286, Contribution No. 138, University of California, September, 1972. 54 p, 9 fig, 2 append, 10 ref.

Descriptors: "Reservoir operation, "Markov processes, "Stochastic processes, "Streamflow, "Optimization, "Reservoir releases, "Reservoir storage, Decision-making, Inflow, Storage capacity, Probability, Equations, Mathematical models, Systems analysis, Hydrology.

Identifiers: *Multi-reservoir systems, *Successive approximations techniques, *Decomposition, *Howard's solution.

The problem of finding an optimal operating policy for two serially-linked water reservoirs is con-sidered. The inputs to the system are streamflow inputs to the respective reservoirs, and the outputs are releases from the respective reservoirs made by the operator of the system, where the output of the upstream reservoir is also an input to the downstream reservoir. A reward, which is a func-tion of the state (i.e., reservoir level, release and time) of the system, is received by the operator of the system and hence, the problem becomes one of determining an operating policy which will max-imize the return to the system operator. The problem is modelled as a Markov decision process, which is a stochastic process. A new solution technique, which is an application of the clas-sical successive approximations technique, and which will solve the problem more efficiently than was previously possible, is presented. (Bell-Cornell) W73-02707

A SOUTHERN OUTPOST OF STEPPE RAVINE FOREST IN SEMI DESERT, (IN RUSSIAN),

A. F. Kireev. Izv Vses Geogr O-Va Vol 101, No 4, p 369-371.

Identifiers: Alder D, Convallaria majalis M, Deserts, *Fern P, Forests, *Nettle D, *Oak D, *Ravines, Steppe, USSR.

On the territory of the 'Gornaya Polyana' training farm of the Volgograd Agricultural Institute there is a ravine 4250 m long which cuts through the Ergeni plateau and the slope toward the Volga. The following associations were noted in this ravine: steppe, Convallaria majalis- and nettle-fern oak forests, and a nettle-fern alder stand. The existence of such associations under the conditions of the northern semidesert is explained by the great depth of the ravine and the steepness of its slopes, which increase the humidity of the habitats.--Copyright 1972, Biological Abstracts, W73-02758

PROBABILITY OF EXCEEDING CAPACITY OF FLOOD-CONTROL SYSTEM AT THE NA-

TIONAL REACTOR TESTING STATION. IDAHO, Geological Survey, Idaho Falls, Idaho.

Geological Survey, Idaho Falls, Idaho. P. H. Carrigan, Jr. Available from NTIS, Springfield, Va 22151-IDO-22052, TID-4500; Price 33.00 printed copy; 95 cents microfiche. Geological Survey Open-file Re-port (IDO-22052), January 1972. 102 p, 10 fig, 12 tab, 4 ref.

Descriptors: "Flood control, "Check structures, "Dams, "Flood routing, "Idaho, Design flood, Snowmelt, Precipitation (Atmospheric), Hydrologic data, Runoff, Streamflow, Flood protection, Flow control, Engineering structures, Reservoirs, Diversion structures, Flood data,

Identifiers: *National Reactor Testing Station (Idaho), *Big Lost River (Idaho).

The flood-control system at the National Reactor Testing Station, Idaho, consists of earth-fill em-bankments which partially dam flow in the Big Lost River and confine the flow diverted at the dam to four spreading grounds (connected in se-ries). Water passing through the dam flows northeastwardly in the river to accumulate in four dry lakes (terminus of the river). Water diverted into the spreading grounds may spill onto unim-proved private lands. Analyses of historical streamflow information indicate that floods in the Big Lost River would overtop the flood-control diversion dam about once every 55 years on the average. If the culverts in the dam are completely plugged, overtopping of the dam would occur about once every 16 years. Effects of synthetically generated snowmelt floods on the flood-control system were analyzed. These analyses indicate that the diversion dam will not be overtopped by a that the diversion dam will not be overloped by a 300-year flood if the capacity of the diversion to the spreading grounds is doubled. Doubling the capacities of channels connecting spreading grounds would be prudent. (Woodard-USGS) W73-02781

ROLE OF VERTICAL SHAFTS IN THE MOVE-MENT OF GROUND WATER IN CARBONATE AOUIFERS.

Cave Research Foundation, Yellow Springs, Ohio. For primary bibliographic entry see Field 02F.

RIVER BASIN MODELING, AN APPROACH TO COMPUTER SIMULATION OF THE BITTER-ROOT-CLARK FORK RIVER BASIN. Montana Water Resources Board, Helena

April 1971. 21 p, 7 fig, 3 tab, 6 ref.

Descriptors: *River basins, *Computer models, Descriptors: "Kiver basins, "Computer models, "Montana, River basin development, Water resources development, "Water demand, Planning, Water supply development, Mathematical models, Model studies, "Simulation analysis. Identifiers: "Bitterroot-Clark Fork River Basin

As a part of the development of Montana's State Water Plan, the use of river basin simulation was investigated with the Bitterroot-Clark Fork River Basin. Using a mathematical model, the simulation was designed to incorporate the main features of the river basin. Maximum land development within the limits of available water resources was the main objective and the model was programmed for a time period of 25 years. Besides providing a plan for this specific region, it was desired to test the validity of such modeling. This computer analysis of stream flows, and potentially irrigable and presently irrigated lands, demonstrates the effects of present stream management, storage programs, and irrigation procedures on the efficient use of water for meeting present and future demands. Twenty computer runs were made; however addi-tional constraints must be considered for future

runs to be valid. The simulation was approached by first defining the area and time to be condered. Eight sub-areas of the basin's 2,410 square miles were formed. System definition further requires a level of problem detail and inclusion of data at various locations as well as indicable. Hydrologic data preparation constitutes a large part of the actual work that goes into the model, as the data need to be processed with con-sideration of past regulation in order to put all data on the same basis. (Poertner)

AN EXPERIMENT IN COMPUTER-ASSISTED SUPERVISORY CONTROL OF A WATER DIS-

SUPERVISORY CUSTROLL OF A BASE CARRY TRIBUTION SYSTEM, General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
H. D. Gilman, M. Y. Goodman, and R. DeMoyer,

Available from the National Technical Informa-tion Service as PB-213 645, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report (1972), 32 p. OWRR C-1725 (No. 3162) (2).

Descriptors: *Water distribution, *Automatic control, *Model studies, Networks, Mathematical models, Computer programs, Regression analysis. Identifiers: *Network analysis, *Control

The object was to apply the results of the completed mathematical model study to a water distribution system. A program was developed for use by operators at the Philadelphia Water Department's Load Control Center. In practice an opera-tor entered current logging data (pump flows, pressures, tank flows, levels) from the district into a timesharing terminal. The program then presented its prediction of the results of operating the vari-ous acceptable pumping combinations for a pro-jected one hour period. Variations in consumer demand were considered by means of a stored demand profile curve developed from an analysis of the Center's logging sheets. The programmed model then made a recommendation for the pump combination to apply in order to achieve as closely as possible specified tank levels (pre-stored as a function of time). Peak power limits for the pumping stations were preserved. The Pressure District simulation was based upon a regression model of logged data. Problems which arose during the experiment resulted from large random variations in the logging data and changing demand patterns with season changes. For real time applications it was concluded that monitoring data must be filtered, and the regression model coefficients periodically updated. If a full network model is used to replicate system status, the model data must be consistent with the true field system. (See also W72-00715) W73-02871

FLOOD HYDROGRAPHS FOR UNGAGED STREAMS, Washington State Water Research Center, Pull-

man. For primary bibliographic entry see Field 02E.

DYNAMICS OF THE POPLAR FOREST AS-SOCIATIONS IN RIVER BASINS OF THE LAKE BAIKAL SOUTHEASTERN SHORE, (IN RUS-SIAN), O. P. Dutina.

Izv Biol-Geogr Nauchno-Issled Inst Pri Irkutsk Univ. 21 p 341-350. 1969.

W73-02880

Identifiers: Aconitum D, *Lake Baikal, River basins, Dynamics, Ferns P, Fir G, *Forests, Grasses M, Lakes, Pine G, *Poplar D, Populus suaveolens D, Rivers, Shore, Spruce G, Stone.

Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control of Water on the Surface

Forests of Populus suaveolens are arranged along the river beds in bests 300-500 m wide and grow up to heights of 950-1000 m above see level. Young poplar seedlings abound in the fresh sand-pebble banks and develop into pure dense young stands with a sparse herbaceous layer. Over the following 20 yr poplar stands thin out, and a herbaceous cover develops under the canopy (forb-poplar forest). With the transition of low floodplain to this floodplain and further thinning, grasses been high floodplain and further thinning, grasses begin to become dominant in the cover and an abundant to become dominant in the cover and an abundant understory of spruce, fir and Siberian stone pine begins to appear. At that point, new young poplar seedlings perish. With the deepening of the river bed, the high floodplain becomes the first terrace above the floodplain, and its lower levels cover coarse forb-poplar forests (Aconitum, fern, etc., 60-90 yr old, in which a subcanopy of dark conifers (spruce, fir) is evident. On the middle levels of this terrace the age of the stands is 90-150 yr and more; they complete the development cycle of pure poplar forests. On the highest levels they are replaced by mixed stands with an admixture of on pure popuar forests. On the highest levels they are replaced by mixed stands with an admixture of popuar 150-200 yr old. The second terrace above the floodplain is covered by a dark-coniferous taiga.—Copyright 1972, Biological Abstracts, Inc. W73-02881

THE RELATIONSHIP BETWEEN LAND USE AND ENVIRONMENTAL PROTECTION, Argonne National Lab., Ill. Center for Environ-

mental Studies. E. J. Croke, K. G. Croke, A. S. Kennedy, and L. J.

A Briefing Document for the Joint Meeting of the President's Water Pollution Control Advisory Board and Air Quality Advisory Board, March 27-31, 1972. 62 p, 1 fig, 2 tab.

Descriptors: *Land use, *Land management, *En-vironmental effects, *Pollution abatement, Planning, Coordination, Local governments, State governments, Federal government. governments, Federal governments, Identifiers: *Pollution control.

In certain highly developed and urbanized areas, the concentration of pollution-producing sources is such that the application of the best pollution control technology may not be sufficient to achieve environmental quality standards. In other areas, economic development and population growth may result in the obsolescence of pollution ntrol programs that are initially effective. This unfortunate geographical concentration of pollu-tion-producing sources is a direct result of past and present land use decisions. Consequently, adequate pollution control may require not only the use of available technology, but also the use of the use of available technology, but also the use of land management policies designed to control the future location of pollution-producing activities. Several analytical planning tools which might prove helpful in evaluating the relationship between land use and environmental quality are briefly examined. Alternative institutional arrangements capable of combining land use rangements capable of combining land use planning with environmental quality control are also discussed. For an environmentally relevant land use policy to be effective, the methods, procedures, and activities of land use planning and regulatory agencies will have to be integrated with those of environmental acceptations. those of environmental protection agencies. Traditionally, these agencies have employed distinct planning techniques and have promoted separate programs at the local, state, and federal levels. (Settle-Wisconsin) W73-02915

AN ECONOMIC INVENTORY OF THE MIAMI RIVER AND ITS ECONOMIC AND ENVIRON-MENTAL ROLE IN BISCAYNE BAY, Miami Univ., Cora Gables, Fla. C. B. Austin.

Mismi Univ., Coral Gables, Fla. Sea Grant Technical Bulletin No. 17, October, 1971. 106 p, 12 tab, 11 maps, 13 graphs. 2-35147.

Descriptors: *Rivers, *Economic impact, *En-vironmental effects, *Land use, Employment, Water pollution, Population, Boats. Identifiers: *Miami River (Florida), *Inventory, *Economic inventory.

A 1971 economic inventory of Florida's Miami River is summarized. The inventory focused on land use, employment, boats, population, and polution along the Miami River. The economic activities along the river were classified as (1) marine activities; (2) light manufacturing; (3) warehouse, wholesale, retail, and office buildings; (4) institutions and private clubs; (5) junk yards and scrapmetal shops; (6) recreation; (7) vacant property and parking lots; and (8) dwellings. The inventory indicated that approximately 67 percent of the overall riverfront is occupied by commercial activities while about 39 percent of the riverfront is occupied by directly marine-related activities. Residential areas provide the mooring facilities for a large number of boats that would otherwise be necessarily located in commercial marinas. Marine large number of boats that would otherwise be necessarily located in commercial marinas. Marine activities were found to be the most important source of employment along the riverfront. By far the most damaging source of pollution found on the Miami River is from sewage. The physical and economic aspects of the river's pollution are examined. Also considered is the economic and environmental relation between the river and the entire Biscayne Bay area. Numerous graphs and tables present data generated by the inventory. (Settle-Wisconsin) W73-07923 W73-02923

A COMPUTER SIMULATION MODEL FOR FLOOD PLAIN DEVELOPMENT, PART 1: LAND USE PLANNING AND BENEFIT EVALUATION, INTASA, Menlo Park, Calif. N. V. Arvanitidis, J. Rosing, D. P. Petropoulos, D. G. Luenberger, and R. C. Lind. Available from the National Technical Information Service as AD-742 195, \$3.00 in paper copy, \$0.95 in microfiche. Army Engineer Institute for Water Resources, Report 72-1, February, 1972. 84 p, 20 fig, 19 ref.

Descriptors: *Computer programs, *Simulation analysis, *Flood plains, *Management, *Planning, *Land use, *Flood damage, *Forceasting, Economic activities, Human population, Systems analysis, Mathematical models, Flood control, Cost benefit analysis, Water resources developed. Cost-benefit analysis, Water resources development, Evaluation.

Identifiers: *Benefit evaluation, Economic rent, Equilibrium land rents, Public policies.

Analytical progress in the formulation of a com-Analytical progress in the formulation of a com-puter simulation model for flood plain develop-ment is presented. Described in detail is a concep-tual model including five major parts: (1) forecast-ing activities to available land; (3) integrating public policies restricting land use; (4) measuring and projecting flood damages; and (5) evaluating benefits based on appropriate formulas using flood damages reduce, land rents, and economic rent differences (locational advantages). Several condamages reduce, tail relas, and economic ten-differences (locational advantages). Several con-cepts are introduced to solve problems associated with development of a simulation model, including: A practical definition of the study are in conjunction with a dummy location; a tow level allo-cation for land use planning; the use of economic rent differences and equilibrium land rents in benefit measurement instead of only economic rents; and the use of cycles of relocations as an to orderly evaluation of benefits. (Bell-Cornell) W73-02944

FLOOD CONTROL METHOD AND AP-PARATUS, M. Lukawsky

U.S. Patent No 3,609,979, 2 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 891, No 1, p 69, October 5, 1971.

Descriptors: "Patents, "Flood control, Impellers, Water control, Flood routing, Flood protection, Flow control, Equipment.

An open-ended tubular body is adapted to be sub-merged in a waterway. An impeller is supported within the tubular body and rotates about an axis which is oriented longitudinally with respect to the tubular body. Rotation of the impeller forces water through the tubular body from an area where flooding has occurred to a downstream area. Buoyant hull-like supporting bodies contribute to the mobility. The hulls are shaped so that when nested together across the waterway, they will provide an effective barrier to the return flow of water to the flooded area. (Sinha-OEIS) W73-03101

FLOOD CONTROL AT MUSCATINE, IOWA (FINAL ENVIRONMENTAL IMPACT STATE-MENT). Army Engineer District, Rock Island, Ill.

Available from the National Technical Informa-tion Service as PB-204 500F, \$3.00 in paper copy, \$0.95 in microfiche. February 15, 1972, 13 p.

Descriptors: *Iowa, *Flood control, *Environ-Descriptors: *Iowa, *Flood control, *Environ-mental effects, *Levees, *Flood data, Flood rout-ing, Flood forecasting, Administrative decisions, Project planning, Natural resources, Adoption of practices, Comprehensive planning, Psychological aspects, Flood protection, Pumping plants, Chan-nel improvement. Identifiers: *Environmental impact statements, *Mad Creek (Iowa).

The proposed flood control project on Mad Creek at Muscatine, lowa, consists of improvement of existing earthen levees, construction of new levees, concrete flood-walls, closure structures, ponding areas, a pumping plant, and partial creek realignment. Environmental impacts of the proposed project will be protection for commerproposed project will be protection for commer-cial and industrial property; disruption and loss of aquatic and terrestrial habitat and environs, ex-pansion of development within flood plain, tempo-rary increase in siltation during construction, and mitigation of certain environmental losses and enhancement of some existing areas through reseeding and planting programs. Adverse en-vironmental effects will be the alteration of existing shoreline, loss of existing bottomland vegeta tion, and a temporary deterioration of land areas by borrow and ponding. Alternatives such as reservoirs, channel improvement, alignments of protective works, and no project were considered but found economically infeasible. Benefit-cost ratio for the proposed project is 4.5:1.0. (Widman-Florida) W73-03017

THE IMPACT OF WATER DEVELOPMENT ON THE ECOLOGY OF RIVER SYSTEMS. Texas A and M Univ., College Station. For primary bibliographic entry see Field 05B. W73-03068

PATTERNS OF DRAINAGE AREAS WITH RAN-DOM TOPOLOGY, California Univ., Irvine. Dept. of Geography.

C. Werner. Geographical Analysis, Vol 4, No 2, p 119-133, April, 1972. 3 tab, 3 fig, 12 ref.

Descriptors: *Probability, *Drainage patterns (Geologic), *Simulation analysis, Methodology, Analytical techniques, Mathematical studies, *Statistical models, Topography, Geomorphology, Channel morphology, *Surface drainage, Geography, Topographic mapping, Surveys, Orography, Canyons, Ravines.

A direct transfer of Shreve's investigation of channel networks to the subject of drainage divide pat-

terns was absence o different work of g cur. Mod vestigate grouped a Empirical sumptions W73-0307

ENVIRON TERN OF NORTH R Illinois Un For prima W73-03071

TWO MO California C. Werner Canadian (7 tab, 4 fig.

Descriptor gy, *Probe *Geologic Geology, (cal studie design, Ma Among the

merger of stream nun geology and Werner, in topological different m These are tested. Both geologic co networks is gard to asse dict the geo as well as th the two moo served diffe sampled in Test results reject one m fail to match statistical ac ditions. Futi gy will then vironmental consisting of cept of rande W73-03079

MORPHOL MESQUITE PICLORAM Agricultural Research Div H. M. Hull, a Weed Science 1971. 1 tab. 1

Descriptors: Weed contr trol, Growth physiology, I Poisons, Plan

Picloram and variety of w plant species, species or mu This study w

WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Control of Water on the Surface-Group 4A

terns was investigated. It is assumed that in the terns was investigated. It is assumed that in the absence of environmental control, all topologically different patterns formed by the drainage areas (drainage polygons) of the links of a channel network of given magnitude n are equally likely to occur. Models are presented which are used to institute distribution of desires applicates whether the second control of the control o cur. Models are presented which are used to in-vestigate distribution of drainage polygons when grouped according to the number of their sides. Empirical data are compared to hypothetical as-sumptions to test reliability. (Black-Arizona)

ENVIRONMENTAL INFLUENCE ON THE PAT-TERN OF PLANT COMMUNITIES ALONG THE NORTH RIM OF THE GRAND CANYON, Illinois Univ., Urbana. Dept. of Botany. For primary bibliographic entry see Field 021. W73-03078

TWO MODELS FOR HORTON'S LAW OF STREAM NUMBERS, California Univ., Irvine. Dept. of Geography.

C. Werner.

Canadian Geographer, Vol 16, No 1, p 50-68, 1972. 7 tab, 4 fig, 25 ref.

Descriptors: "Hortons Law, "Channel morphology, "Probability, "Drainage patterns (Geologic), "Geologic investigations, Analytical techniques, Geology, Geomorphology, Networks, Mathematical studies, Sampling, Topography, Network design, Mathematical models. Identifiers: Topology, Bifurcation ratio.

Among the various alternatives to generate and evaluate models of drainage systems, the random merger of channels, and the measurement by stream numbers have received major attention in geology and geomorphology, Shreve, in 1966, and Werner, in 1969, constraining their studies to the topological aspects of channel networks, proposed different models for merging drainage channels. These are reviewed, extended, compared and tested. Both models assume that, in the absence of geologic controls, the topological configuration of networks is a matter of chance, differing with regard to associated probabilities. Both models predict the geometric progression of stream numbers, as well as the average bifurcation ratio. Neither of the two models is capable of accounting for the ob-served differences between stream number data sampled in the eastern and western United States. Test results do not provide sufficient evidence to reject one model in favor of the other; rather, both fail to match observed patterns within the limits of statistical acceptability even under sampling conditions. Future models of channel network topology will therefore have to add other (spatial) environmental variables to the present model input consisting only of network nagnitude and the concept of randomness. (Black-Arizona)
W73-03079

MORPHOLOGICAL RESPONSE OF TWO MESQUITE VARIETIES TO 2,4,5-T AND MESQUITE PICLORAM,

Agricultural Research Service, Tucson. Plant Research Div.

H. M. Hull, and H. L. Morton. Weed Science, Vol 19, No 6, p 712-716, November 1971. 1 tab, 1 fig, 12 ref.

Descriptors: "Herbicides, "2-4-5-T, "Mesquite, "Weed control, "Chemical control, "Brush control, Growth chambers, Plant morphology, Plant physiology, Limiting factors, Resistance, Weeds, Poisons, Plant growth regulators.

Picloram and 2,4,5-T have been used to kill a wide Picloram and 2,4,5-T have been used to kill a wide variety of woody plants. Although these herbi-cides are highly effective against numerous woody plant species, they are ingffective on certain other species or must be used at excessively high rates. This study was conducted to investigate ways of overcoming this lack of effective control in resistance species. Honey mesquite (Prosopis ju-liflora var. glandulosa) and velvet mesquite (P. juilifora var. glandulosa) and vervet mesquite (P. ju-lifora var. velutina) seedlings were treated on in-dividual leaves with 20 or 40 ug of 2,4,5-T, picloram, or a 1:1 mixture thereof. Formulation of herbicides in a DMSO-complex carrier enhanced activity considerably over that obtained with an activity consultanty over that obtained with an aqueous carrier, the degree of enhancement being greater with 2.4.5-T. Lack of major varietal dif-ferences in morphological or anatomical response suggests that observed varietal differences in sensitivity of field mesquite to aerial sprays are not a function of the variety itself, but are related to climatic or edaphic differences among sites which the varieties occupy. (Black-Arizona) W73-03080

CONTENTS OF OXYGEN IN SOIL WATER AND CO2 IN SOIL AIR IN FOREST BOGS OF THE CENTRAL UKRAINIAN POLESTE (IN

O. Y. Polyakova.

O. 1. FOIYAKOVA. Visn Sil' *Kohospod Nauk. 6 p 63-66. 1970. Identifiers: Air, *Bogs, *Carbon dioxide, Forests, Oxygen, Soil, *Ukrainian polesie, USSR, *Drainage.

Drainage of bogs considerably reduced the CO2 content of air and increased the O2 content of soil water. No regular relationship was detected between O2 in soil waters and drainage, but the former increased after drainage. These processes promote forest growth and increase productivity in drained areas .-- Copyright 1972, Biological Abstracts, Inc. W73-03091

THE WARWICKSHIRE AVON: A CASE STUDY OF WATER DEMANDS AND WATER AVAILA-BILITY IN AN INTENSIVELY USED RIVER

SYSTEM,
Edinburgh Univ. (Scotland). Dept. of Forestry and
Natural Resources. For primary bibliographic entry see Field 06D. W73-03103

LAND-USE PLAN FOR THE ARID SOUTHWEST, New Mexico State Univ., University Park, Dept.

For primary bibliographic entry see Field 06B. W73-03120

A METHODOLOGY FOR ESTIMATING THE BENEFITS TO IRRIGATED AGRICULTURE FROM INCREASED ACCURACY IN SEASONAL STREAMFLOW FORECASTS, Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 03F. W73-03130

EFFECTS OF AN ARTIFICIAL STREAM ON MARINE COMMUNITIES, Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.

For primary bibliographic entry see Field 05C. W73-03171

SELF-VERIFYING HYBRID COMPUTER A SELF-VERIFYING HYBRID COMPO MODEL OF RIVER-BASIN HYDROLOGY, Utah Water Research Lab., Logan. For primary bibliographic entry see Field 02A. W73-03183

TRANSISTORIZED LEVEL SWITCHING CIR-CUITS (ON OFF CONTROLLER) AND THEIR POSSIBLE APPLICATIONS TO WATER RESERVOIR: II, ertilizer Corp. of India, Sindri.

G. P. Gupta.

Technol Q Bull Develop Div Fert Corp India. Vol

7, No 4, p 303-309. 1970. Illus. Identifiers: *Circuits, *Controllers, *Reservoirs, Transistorized circuits, Water consumption.

Close observation and control over water reservoirs are essential when there are considerable fluctuations in the daily consumption of watms e.g. on holidays and festivals. Level switch is an important tool in managing liquid level problems. Some practical circuits are given. Performance has been tested between ambient temperatures of 0 - 50 C.—Copyright 1972, Biological Abstracts, Inc. W73-03198

EARLY GROWTH AND DEVELOPMENT OF SLASH PINE UNDER DROUGHT AND FLOOD-

Forest Service (USDA), Athens, Ga. Forestry Sciences Lab.
J. W. McMinn, and W. McNab.

US Forest Service Research Paper, 89, p 1-10,

Identifiers: *Drought tolerance, *Flooding, Plant growth, *Slash Pine, Pinus elliottii var densa G, Pinus elliottii var elliottii G.

Development of typical slash pine (Pinus elliottii var. elliottii) and South Florida slash pine (Pinus elliottii var. densa Little and Dorman) was studied under conditions simulating south Florida's winter-spring droughts and summer floods. One of 3 degrees of flooding was imposed on seedlings which had been subjected to one of 3 degrees of drought. The drought period is more limiting to development of slash pine seedlings than is the subsequent wet period.—Copyright 1972, Biologi-cal Abstracts, Inc. W73-03207

SOME PROBLEMS OF THE OPTIMAL USE OF A BASIN WATER RESOURCES ON THE BASIS

OF MATHEMATICAL MODELLING, Akademiya Nauk Gruzinskoi SSR, Tiflis, Institut Energetiki.

G. G. Svanidze.

In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 229-232, 29 August-3 September 1970. 4 p, 7

Descriptors: *Basins, *Water resources, *Mathematic models, *Optimization, Economics, Technology, Dynamics, Stochastic processes, Ru-noff, Hydrologic aspects, Monte Carlo Method.

The technical-economic substantiation of plans for the development of a water-economy system utilizing the water resources of a basin were based on the working out of appropriate mathematical models which took account of the particular natural conditions of the region and the interests of various components of the water-economy com-plex in the dynamics of their development. Since, in its natural state, river runoff was a non-stationary stochastic process, the methods of calculation were based on the application of an adequate mathematical apparatus, such as the theory of random functions. Initial information on the runoff was supplied by hydrometric observations of the regime of water-discharge variations which were of relatively short duration. Water resources at various sections of a basin were mutually correlated in space and time, being approximated by asymmetric probability distributions. This task was solved on the basis of group modelling of hydrological series by the Monte Carlo Method. On the basis of previous hydrometric observations it was possible to determine the one-dimensional distribution function and the correlated function. (Veverka-Cornell)

Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A-Control of Water on the Surface

OPTIMIZATION OF BASIN WATER RESOURCES UTILIZATION,
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In

Akademya Nauk Kazakhskoi SSR, Alma-Ata. Institut Energetiki.

N. S. Kalachev, and Sh. Ch. Chokin.
In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 233-236, 29 August-3 September 1970. 4 p, 2 ref.

Descriptors: *Basins, *Water resources, *Optimization, Planning, Economics, Runoff, Water storage, River systems.

The 'purpose' of the control process and the quantitative expression in water resources planning and optimization is examined. It was based on the principle of economic use of natural water resources. The second step in the solution of the task was the choice of the best way to approach the number. choice of the best way to approach the purpose. This was calculated on the basis of minimum total outlay involved in consecutive realization of the system. As a limitation on the choice of a development trajectory, conditions of meeting production needs at each intermediate stage of development were used. Three reference levels of planning were proposed: (1) utilization of the local (intra-basin) water resources; (2) inclusion of resources of adjacent sources (level of inter-basin water connections; and (3) utilization of resources from other sources (long-distance transport of runoff). The integrated utilization of water resources was based on long-term regulation of the natural river runoff by water storage systems. Analysis of the established tendencies in the development of the river runoff regulation theory showed that the main role belonged to the methods and calculation procedures based on the use of generalized runoff characteristics which were determined on the basis of natural observations. (Veverka-Cornell)

OPTIMUM USE OF WATER RESOURCES OF

BASINS IN IRRIGATION, Tsentralnyi Ekonomiko-Matematicheskii Institut,

For primary bibliographic entry see Field 03F.

THE ADRIA (MONFALCONE) - DANUBE BASIN INTERNATIONAL WATERWAY, Vodogradbeni Laboratorij, Ljubljana (Yu-

goslavia). W. Praprotnik. In: Proceedings of 14th International Association

for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 273-276, 29 August-3 September 1970. 4 p, 1 fig.

Descriptors: *Basins, *Canals, *International waters, *Trafficability, Navigation, Construction, Construction costs, Economics, Planning, Identifiers: *Adria (Monfalcone) - Danube Basin.

Due to the large markets of Eastern Central Europe, the need for a fifth main traffic route toward the Adriatic Sea was discussed. The planned con-tinental navigable Adria-Danube waterway with its starting point at the Italian harbor of Monfalcone was presented. Engineering, traffic and economic aspects were considered. The construction characteristics of the Adria-Danube Canal conformed to the engineering standards applied with the Rhine-Main-Danube passageway as well as with the canal network of the Monfalcone-Venice coastal-way and the North Italian internal navigation system. The presumed traffic in both directions was estimated according to statistics of contemporary in-ternational exchange of goods most suitable to waterborne transport (30 to 50 million tons annually). The construction expenditures, that would affect in a revolutionary way the existing system of communications by reducing the shipping costs pro tkm, was estimated at about \$1 200 million and would have to be shared by the interested countries. (Veverka-Cornell) W73-03230

AN ALTERNATIVE APPROACH FOR FINDING OPTIMAL CONTROL RULES OF RESERVOIR

OPTIMAL CURRENT OF CIVIL Engineering; Tokyo Univ. (Japan). Dept. of Civil Engineering; and North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning. Y. Takahasi, and K. Takeuchi.

11. Hanness, and R. I arcuch. In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol. 5, p. 301-304, 29 August-3 September 1970. 4 p. 2

Descriptors: "Reservoirs, "Control, "Management, Optimization, Mathematical studies, Simulation analysis, Computers, Dynamic programming, Stochastic processes, Linear programming, Constraints, Flood control.

Technical problems especially on computational feasibilities were reviewed and analyzed. Two exteasionnes were reviewed and analyzed. I wo ex-amples of an alternative approach, namely con-verting a real complexed problem into a computa-tionally manageable size, were presented. Although the orthodox mathematical improvement approach should not be less emphasized, it seemed an urgent task to recognize the common barriers of an urgent task to recognize the common barriers of all existing techniques for optimal control of reservoir systems. The simulation technique although an advantage as a simple procedure to handle a complex system, was ineffective as an optimiza-tion technique especially for finding control rules tion technique especially for finding control rules as it required a great number of samplings and a great amount of computer time. On the other hand, dynamic programming did not require linearity or concavity of objective functions and constraints, and easily handled stochastic models. Although it suffered the 'curse of dimensionality', it had a stronger theoretical basis than linear pro-gramming. Two examples of alternative apgramming. Two examples of alternative approaches to develop a systematic simplification theory to make a real complexed problem manageable by existing techniques were: (1) a study on the optimal storage for flood adjustment; and (2) a development of theories for simplifying or decomposing a complex system to a simple but essentially identical system. (Veverka-Cornell) W73-03231

SOME CHARACTERISTICS AND APPLICA-SUME CHARACTERISTICS AND APPLICA-TIONS OF MATHEMATICAL PROGRAMMING MODELS IN WATER RESOURCE SYSTEMS, Meta Systems, Inc., Cambridge, Mass. For primary bibliographic entry see Field 06A. W73-03232

PRELIMINARY ANALYSIS OF SURFACE WATER AVAILABILITY, Saskatchewan-Nelson Basin Board, Regina.

John A. Kerr.

John A. Kerr.
In: Proceedings of 14th Congress of International
Association for Hydraulic Research, Hydraulic
Research and its Impact on the Environment, Vol
5, p 305-314, 29 August-3 September 1970. 10 p, 8
fig, 1 tab, 5 ref.

Descriptors: *Surface waters, *Systems analysis, *Reservoirs, Rivers, Simulation analysis, Evaporation, Streamflow. Identifiers: Saskatchewan-Nelson Basin.

Analysis techniques utilized in a preliminary study of water availability in three provinces of Western Canada were described. The purpose of this, with particular reference to the Saskatchewan-Nelson particular reference to the Saskatchewan-vessor Basin Study, was to list the tools used in the systems analysis of the network of rivers and proposed projects for storage and diversion. The advantages and limitations of the various methods employed in the analysis of the system of existing and proposed watercourses and reservoirs were stressed. A high-speed multi-reservoir simulation model computed evaporation as a function of reservoir area and involved an upstream-to-downstream loop to redefine minimum and maximum flows and a downstream-to-upstream loop to determine actual flows and end-of-month reservoir conditions. It was seen that the keys to success of multi-reservoir analysis were carefully created data banks at various levels, flexible and fully general models, a hierarchy of models of different types, and a final versatile general-purpose multi-reservoir simulation model. A model 360-85 computer was used. (Veverka-Cornell)

ON THE OPTIMIZATION OF THE DESIGN OF STORAGE AREAS AT RIVER DAMS, Technische Hochschule, Munich (West Germany). G. J. Seus, and W. Bauch.

G. J. Seus, and w. Sauca. In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 283-292, 29 August-3 September 1970. 10 p, 2

Descriptors: *Dams, *Rivers, *Weirs, *Storage, *Design, *Optimization, Computers, Costs, Excavation, Decision making.

A method which (using a high speed computer) permits optimization of design costs for storage areas at river weirs was described. The problem was to satisfy the constraint of the remote storage target level and to plan and carry out the necessary construction operations at minimum overall cost. To ensure fulfilment of the central condition for the storage area design, i.e., maintenance of the remote storage target level, cross-sections of the dammed river were made sufficiently large. The depicted method of optimizing storage area design was of the non-linear type. It was continuous, since the apparently discrete assumptions of step-by-step changes in foreshore excavation and river bed widening could be replaced by any desired in-termediate value. The optimization method had manifestly deterministic features. Two important mannessy deterministic teatures. I wo important advantages of this optimization method were: (1) the method was generally applicable to the dimensioning of storage areas in rivers in connection with the construction of weirs, and (2) basically it required no more data and initial information than e calculation of any steady back water curve. (Veverka-Cornell)

EFFECT OF RESERVOIR DRAWDOWN ON OP-

TIMAL OPERATION, Virginia Polytechnic Inst. and State Univ., Blacksburg, Va. Dept. of Civil Engineering. J. M. Morgan, and P. H. King.

In: Proceedings of 14th Congress of International na. r. rocceoungs or 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 341-343, 29 August-3 September 1970. 3 p, 3 ref.

Descriptors: *Multiple-purpose reservoirs, *Drawdown, *Operations, *Recreation demand, Statistical methods, Monte Carlo method, Dynamic programming, Economics, Optimization

Due to the deamand for recreational development of multipurpose water resource project sites, there was a need to determine the extent to which the operating schedules of reservoirs reflected the interest of recreational users. Recreation attendance at a number of reservoirs operated by the United at a number of reservoirs operated by the United States Army Corps of Engineers was studied using a statistical approach. Also, the effect of recrea-tion values on the operating schedules selected by a Monte Carlo dynamic programming model for the economic optimization of the operation of a reservoir system was examined. Results indicated that moderate drawdowns did not adversely effect recreation sites, but \$1.60/visite practice, minimum b of operatin W73-03244

4B. Gro

MICROBIA WATER, Illinois Uni For primary W73-02602

GROUNDY SATURATI Rhode Islan Environment For primary W73-02624

WATER FO COPIAH A SIPPI, Geological S For primary W73-02651

GEOLOGY PAJARO V MONTERE Geological S K. S. Muir. Geological 1972. 33 p, 1

Descriptors: characteristi *California, Pumping, W Groundwate Water quali Curves, Geo Identifiers: *

Groundwater California, i Precipitation reaches the tion or by see the Pajaro R carrying run the valley, a Aptos area southeastwar area. Ground under confin ception is gro part of the a Water levels feet lower the age averaged period 1963 t semiperched deeper, conf Also, sea-wat areas near the vicinity of M about 13,000 lation in the a agriculture. T ples, sugar grains. (Wood W73-02653

THE NATU DEPOSITS AT

WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Groundwater Management—Group 4B

recreational attendance at multipurpose reservoir sites, but that the recreation benefit of about sites, but that the recreation benefit of about \$1,50/visitor-day, generally accepted in American practice, might be a better indicator of the minimum benefit than the maximum for the range of operating schedules studies. (Veverka-Cornell) W73-03244

4B. Groundwater Management

MICROBIAL MODIFICATION OF GROUND nois Univ., Urbana. Water Resources Center. For primary bibliographic entry see Field 05B.

GROUNDWATER FLOW IN PARTIALLY GROUNDWATER FLOW IN PARTIALLY SATURATED SOILS, Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering. For primary bibliographic entry see Field 05B. W73-02624

WATER FOR INDUSTRIAL DEVELOPMENT IN COPIAH AND SIMPSON COUNTIES, MISSIS-

Geological Survey, Jackson, Miss.
For primary bibliographic entry see Field 03E. W73-02651

GEOLOGY AND GROUND WATER OF THE MONTEREY COUNTIES, CALIFORNIA, Geological Survey, Menlo Park, Calif. K. S. Muir.

Geological Survey Open-file Report, June 27, 1972. 33 p, 11 fig, 34 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, "Water wells, "Hydrologic data, "California, Water supply, Water utilization, Pumping, Withdrawal, Water level fluctuations, rumping, windrawai, water level incumations, Groundwater recharge, Basic data collections, Water quality, Saline water intrusion, Maps, Curves, Geology, Hydrogeology, Identifiers: *Pajaro Valley area (Calif.).

Groundwater in the 120 sq mi Pajaro Valley area, California, is derived from three sources: (1) Precipitation within the Pajaro Valley area that Precipitation within the Pajaro Valley area that reaches the groundwater body by direct infiltration or by seepage from streams, (2) seepage from the Pajaro River as it crosses the Pajaro Valley carrying runoff which originates upstream from the valley, and (3) precipitation in the Soquel-Aptos area that infiltrates and then moves southeastward at depth into the Pajaro Valley area Groundwater in most wells in the area occur. area. Groundwater in most wells in the area occurs under confined (artesian) conditions: the only exception is groundwater in the upper, near-surface part of the alluvium and that in the dune sand. Water levels in wells during 1970 averaged about 2 feet lower than those in 1950. Groundwater pumpage averaged 46,100 acre-feet per year during the period 1963 through 1969. There are two distinct groundwater quality zones: a shallow, semiperched zone of poor-quality water and a deeper, confined zone of good-quality water. Also, sea-water intrusion has occurred in limited areas near the mouth of the Pajaro River and in the vicinity of McClusky Slough. Watsonville, with about 13,000 people, is the largest center of population in the area. The economy is based mainly on agriculture. The principal crops are lettuce, apples, sugar beets, tomatoes, artichokes, and grains. (Woodard-USGS)
W73-02653

THE NATURE AND EXTENT OF PEAT DEPOSITS AND POSSIBLE EFFECTS OF PEAT

MINING ON MANMADE FEATURES AND SPRINGS NEAR MESCALERO, NEW MEXICO, Geological Survey, Albuquerque, N.Mex.

Geological Survey Open-file Report, October 1972, 24 p, 6 fig, 2 tab, 1 ref.

Descriptors: *Peat, *Mining, *Environmental effects, *Groundwater resources, *New Mexico, Springs, Groundwater movement, Aquifers, Foundations, Buildings, Roads, Geology, Hydrogeology, 1dentifiers: *Mescalero area (N Mex), Peat

deposits, Peat mining.

A study was made during May 1971 by the U. S. Geological Survey to determine: (1) the nature and extent of peat deposits near Mescalero, N. Mex, (2) whether mining of the peat will affect the stability of three manmade features near the deposits, and (3) whether peat mining will affect springs. Peat deposits with organic-matter contents between 15% and 35% are generally 1- to 2-feet thick and occur within 8 feet of land surface. The deposits underlie an area of about 26 acres. The deposits underlie an area of about 26 acres. The total volume of peat ranges from 40,000 to 80,000 cubic yards. Peat mining is not likely to affect the stability of St. Joseph's Mission because underlying sediments have been prestressed in the geologic past to tolerate possible changes. The Mescalero National Fish Hatchery is built upon soft, and saturated, silts and clays that are subject to settling under stress. Excavation beyond the toe of the 4-percent slope below the hatchery would minimize possible detriment to this feature. State Road 24 is particularly susceptible to damage Road 24 is particularly susceptible to damage because of its construction over silts and clays. Excavation not closer than 200 feet from the road would minimize possible detriment to this feature. Springs near the study area have their sources in fractures of the Permian Yeso Formation. Peat mining is not likely to affect flow of these springs. (Woodard-USGS) W73-02661

WATER RESOURCES OF THE MINNESOTA RIVER-HAWK CREEK WATERSHED, SOUTHWESTERN MINNESOTA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-02663

DISTRIBUTION OF RADIOACTIVITY IN AND NEAR THE RAINIER RUBBLE CHIMNEY, Teledyne Isotopes, Las Vegas, Nev. For primary bibliographic entry see Field 05B.

LONG TERM RELEASE OF RADIOACTIVITY FROM RAINIER MELT-GLASS, For primary bibliographic entry see Field 05B. W73-02727

WATER RESOURCES DATA FOR GEORGIA--1971. Geological Survey, Atlanta, Ga. For primary bibliographic entry see Field 07C. W73-02784

THE AVAILABILITY OF GROUND WATER IN NEW CASTLE COUNTY, DELAWARE, Delaware Univ., Newark. Water Resources

Center. R. W. Sundstrom, and T. E. Pickett. Report, July 1971. 156 p, 35 fig, 32 tab, 71 ref.

Descriptors: "Groundwater resources, "Aquifer characteristics, "Water wells, "Water supply, "Delaware, Hydrogeology, Withdrawal, Water yield, Pumping, Transmissivity, Storage coefficient, Drawdown, Groundwater recharge, Water levels, Water table, Hydrologic data.

Identifiers: *New Castle County (Del).

New Castle County, Delaware, encompasses por-tions of two geological provinces whose ground-water reservoirs vary widely in water-yielding pro-perties. The Appalachian Piedmont Province occu-pies about 113 square miles in northern New Castle County. The remainder of the county (324 square miles) lies in the Atlantic Coastal Plain square miles) lies in the Atlantic Coastal Plain Province. The groundwater reservoirs in the Piedmont are contained in very old rocks of metamorphic and igneous origin. The groundwater reservoirs of the Coastal Plain are in much younger rocks of sedimentary material. The average yield of 103 wells in the Piedmont is about 15 gallons per minute and 80% of the wells yield less than average. The oldest groundwater reservoirs of the Coastal Plain are in the Potomac Formation of Coastacous are. The Potomac aquifers mation of Cretaceous age. The Potomac aquifers are supplying about 15 mgd of water and can probably supply an additional 19 mgd. (Wood-USGS) W73-02785

GRAVITATIONAL AND DISPERSIVE MIXING

IN AQUIFERS, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering. For primary bibliographic entry see Field 02F. W73-02791

SPECIFIC CAPACITIES OF WELLS IN CRYSTALLINE ROCKS,
New Mexico Inst. of Mining and Technology,

Socorro.

W. K. Summers. Ground Water, Vol 10, No 6, p 37-47, November-December, 1972. 14 fig, 1 tab, 24 ref.

Descriptors: "Hydrogeology, "Fractures (Geologic), "Fracture permeability, "Wisconsin, Groundwater movement, Water yeld, "Water wells, Water levels, Hydrologic data, Specific capacity, Aquifer testing, Groundwater resources, Aquifer characteristics.

Identifiers: "Rothschild (Wisc).

In the Rothschild area of Wisconsin, most water wells are completed in glacial deposits. When gla-cial deposits are unsaturated or thin, wells are completed in fractured crystalline rocks of Precompleted in fractured crystalline rocks of Pre-Cambrian age. Yields and specific capacity are generally small, with a median specific capacity of log 0.17 gpm/ft and a mean value of log 0.10 gpm/ft. Wells which are close together may have substantially different specific capacities. The oc-currence of saturated sand and gravel above the crystalline rocks has no obvious influence on yield or specific capacity. Specific capacities of wells seem to be inversely proportional to (a) thickness of rocks penetrated below the water table, (b) depth of the wells below the land surface. Specific capacities of wells are related to the number of contributing fractures penetrated and the number capacities or wests are related to the number of contributing fractures penetrated and the number of fractures diminishes linearly with depth. In exploring for groundwater in a fractured rock, the problem is to find the area of maximum fracturing. Because wells achieve 60 to 80 percent of their yield in the first 20 feet below the water table, test wells should be tested when they have reached a depth of about 20 feet below the water table. (K-napp-USGS)
W73-02800

A NEW TECHNIQUE FOR ESTIMATING RECHARGE USING A DIGITAL MODEL. Geological Survey, Lakewood, Colo. O. J. Taylor, and R. R. Luckey. Ground Water, Vol 10, No 6, p 22-26, November-December, 1972. 6 fig, 6 ref.

Descriptors: *Recharge, *Mathematical models, *Hydrogeology, Numerical analysis, Groundwater movement, Water table, Conjunctive use, Sur-

Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B-Groundwater Management

face-groundwater relationships, Evapotranspira-tion, Water balance, Return flow.

A new digital-computer modeling technique uses A new digital-computer modeling technique uses response curves for discrete regions of a stream-aquifer system to compute the percentage of applied irrigation water and precipitation that recharges the groundwater reservoir. The hydrologic system modeled is a part of the Arkansa River Valley in southeastern Colorado. A 150-mile reach of the valley (Pueblo to the State line) was divided into every smaller scales. mile reach of the valley (Pueblo to the State line) was divided into seven smaller reaches. Streamflow, irrigation water applied from canals, groundwater withdrawal by wells, and precipitation data collected during 1964-68 were considered. A wide range of assumed values of recharge from applied irrigation water and precipitation were simulated by the model. The differences between computed by the model. The differences between computed and measured changes in groundwater storage were extremely sensitive to the programmed recharge value. Convergence of computed and measured change in groundwater storage values was obtained for most reaches when 20 to 30 percent of the applied irrigation water and precip tion was computed as recharge to the aquifer. (K-napp-USGS)
W73-02801

THE USE OF GAMMA LOGS IN DETERMINING THE CHARACTER OF UNCONSOLIDATED SEDIMENTS AND WELL CON-STRUCTION FEATURES, Geological Survey, Columbus, Ohio.

S. E. Norris. Ground Water, Vol 10, No 6, p 14-21, November-

December, 1972. 10 fig. 4 ref.

Descriptors: *Borehole geophysics, *Radioactive well logging, *Gamma rays, Radioactivity, Radioactivity techniques, Logging (Recording), Data collections, Hydrologic data, Hydrogeology, Stratigraphy.
Identifiers: *Gamma logging.

Gamma logs, by revealing differences in the radiation intensity of unconsolidated sediments, can provide important information on the depth and sequence of beds penetrated by a cased well. In some instances the log of a well drilled into a sand and gravel aquifer can indicate the interval, or intervals, most favorable for screening. Changes in logs made before and after a well is screened and developed can show zones in the screened interval developed can snow zones in the screened interval where most development occurred, and provide valuable clues as to the overall effectiveness of development. Although little used at present, gamma logging holds promise of becoming an im-portant tool in hydrologic studies and in the well construction industry. More testing and possibly standardization of equipment is currently needed, along with experimentation in logging techniques, to improve the method. Field correlation between logs and drilling samples are necessary to improve the accuracy of log interpretation. (Knapp-USGS) W73-02802

WATER FOR A RAPIDLY GROWING URBAN COUNTY,

MICHIGAN, Geological Survey, Lansing, Mich. For primary bibliographic entry see Field 03D.

THE AVAILABILITY OF GROUND WATER IN EASTERN SUSSEX COUNTY, DELAWARE, Delaware Univ., Newark. Water Resources

R. W. Sundstrom, and T. E. Pickett. Report, June, 1969. 136 p, 36 fig, 12 tab, 76 ref.

Descriptors: *Groundwater resources, *Aquifer characteristics, "Water wells, "Water supply, "Delaware, Hydrogeology, Withdrawal, Water yield, Pumping, Transmissivity, Storage coeffi-

cient, Drawdown, Groundwater recharge, Water levels, Water table, Saline water intrusion, Water quality, Saline water-freshwater interfaces, Coasts, Hydrologic data. Identifiers: "Sussex County (Del).

The availability of groundwater was studied in an area of about 485 square miles of eastern Sussex County, Delaware, that drains eastward toward Delaware Bay and the Atlantic Ocean. The amount of groundwater used in eastern Sussex County for of groundwater used in eastern Sussex County for all purposes averaged about 18 million gallons a day in 1966. The available groundwater in eastern Sussex County amounts to more than 140 mgd. Of this amount, about 71% of the groundwater is available in the water-table aquifer of the Pleistocene and subcropping Manokin and Pocomoke aquifers. In the southern part of the area where the Mnokin is under arteaian pressure, the Manokin contains about 15% of the total contains a available supply. The remaining 5 artesian aquifers of the area are of minor importance, and together they contain only about 14% of the total available

USGS) W73-02805

THE AVAILABILITY OF GROUND WATER IN REFERENCE TO THE DOVER AREA,
Delaware Univ., Newark. Water Resources

supply. Salt-water problems occur in the coastal area of eastern Sussex County where the water table is less than 5 feet above sea level. (Woodard-

Center. R. W. Sundstrom, and T. E. Pickett. Report, June, 1968. 123 p, 35 fig, 24 tab, 66 ref.

Descriptors: *Groundwater resources, *Aquifer Descriptors: "Groundwater resources, "Aquiter characteristics, "Water wells, "Water supply, "Delaware, Withdrawal, Water yield, Pumping, "Plydrogeology, Transmissivity, Storage coefficient, Drawdown, Groundwater recharge, Water level fluctuations, Water table, Hydrologic data. Identifiers: "Kent County (Del).

Groundwater is available in most of Kent County, Delaware, from several sources. The Rancocas aquifer, in the extreme northern and porthwestern aquiter, in the extense notice in an universely parts of the county, has possible yields to wells of about 50 gpm to about 600 gpm. The ultimate yield of the aquifer is computed to be about 4 mgd. The Piney Point aquifer crosses the count in a northeast-southwest direction. The maximum yield of the aquifer is about 17 mgd. The Cheswold aquifer is available in much of the County, except in the northern part. The Cheswold is especially productive in the Dover Air Force Base area where pumpage has averaged as much as 6,500,000 gpd during peak demands. Small to large supplies can be obtained from the water table aquifer in the Pleistocene which extends over 88% of the county. The combined use of all of the aquifers in the county in 1966 amounted to an average of 17, 856,000 gpd. This is 275% greater than the quantity used in 1953. (Woodard-USGS)

GROUND-WATER RESOURCES AND GEOLO-GY OF COOK COUNTY, GEORGIA,

Geological Survey, Atlanta, Ga. C. W. Sever.

Geological Survey Open-file Report, 1972. 40 p, 13 fig, 6 tab, 15 ref.

Descriptors: *Groundwater resources, *Geology, *Aquifer characteristics, *Water wells, *Georgia, Hydrogeology, Water quality, Water yield, Withdrawal, Pumping, Water level fluctuations, Water utilization, Water supply, Hydrologic data, Drawdown, Chemical analysis.

Aquifer-performance tests and aquifer studies indicate that the limestone beneath the city of Adel and probably most of Cook County, Georgia, contains potable water to a depth of only about 400 to 500 feet and that 'deep' wells that tap these limestones obtain most of their water from a few thin, highly permeable zones rather than from the entire thickness of the rocks. Below about 500 feet the water is mineralized and not potable without treatment. The yield of 'shallow wells' is variable and the water generally is corrosive and at places contains appreciable dissolved iron. The volume of groundwater flowing through the Suwannee and Marianna Limestones in Cook County and available for development to properly spaced wells and well fields is estimated to be about 18,000,000 gallons per day. Available water in the Tampa Formation is estimated to be about 1,500,000 gallons per day. Water levels near the center of the Adel well day. Water levels near the center of the Adel well field have declined 38 feet since 1890 and presently are declining at a rate of 1.6 feet per year. (Woodard-USGS)
W73-02807

CHEMICAL AND BACTERIOLOGICAL QUALI-TY OF WATER AT SELECTED SITES IN THE SAN ANTONIO AREA, TEXAS, AUGUST 1968-APRIL 1972.

Geological Survey, Austin, Tex. For primary bibliographic entry see Field 05B. W73-02808

REGIONAL HYDROGEOLOGIC INVESTIGA-TIONS IN KAZAKHSTAN (REGIONAL'NYYE GIDROGEOLOGICHESKIYE ISSLEDOVANIYA

V KAZAKHSTA Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-stitut Gidrogeologii i Gidrofiziki.

Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, Akhmedsafin, U.M., editor, 1971. 244 p.

Descriptors: *Hydrogeology, *Groundwater, *Groundwater resources, *Groundwater availability, Groundwater movement, Groundwater bility, Groundwater movement, Groundwater recharge, Groundwater mining, Aquifers, Aquifer characteristics, Water balance, Water types, Water chemistry, Water quality, Water supply, Water utilization, Water wells, Lakes, Arid lands, Agriculture, Mining.

Agriculture, mining. Identifiers: *USSR, *Kazakhstan, *Lake Balkhash, *Piedmont plains, Depressions (Geologic), Geography, Balneology, Mineralization.

This collection of 29 papers presents the results of hydrogeologic studies in arid regions of Kazakhstan. Distribution, occurrence, movement, replenishment, and chemical quality of groundwaters in different parts of the Republic are examined together with utilization of aquifers in the national economy to meet the needs for irrigation, industrial industrial and a contraction. national economy to meet the needs for ringation, industrial, urban, and rural water supplies. Quantitative estimates of groundwater resources in the Republic are given for the period 1976-80, and the role of groundwater in maintaining the level of Lake Balkhash, the largest lake in central Kazakhash, the largest lake in central Kazakhash. stan, is discussed in connection with construction of the Kapchagay Reservoir in lower reaches of the Ili River. (See W73-02810 thru W73-02818) (Josefson-USGS) W73-02809

GROUNDWATERS OF KAZAKHSTAN AND RECOMMENDATIONS REGARDING THEIR USE IN THE NATIONAL ECONOMY FOR 1976--80 (PODZEMNYYE VODY KAZAKHSTANA I REKOMENDATSII PO IKH ISPOL'ZOVANIYU NARODNOM KHOZYAYSTVE V PERIOD S

1976 PO 1980 G.), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki. U. M. Akhmhedsafin, M. Kh. Dzhabasov, and V.

r. Sniygma. In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstana; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 9-26, 1971. 2

Descripto *Grounds bility, *P supply, W cept cons water, M tion, Agri

The supp trillion cu water. Th water is 3 storage is where ged pasture in and agricu and weak each of Republic water with tional eco W73-02810

ROLE OF THE LEV UROVNY Akademiya stitut Gidro U. M. Akh In: Regio ledovaniya Kazakhsko Gidrofiziki

Descriptor *Lakes, *\ Irrigation, Reservoir o hash, Ili Ri The possib Balkhash a

connection Reservoir a in lower proposals in compensate rice fields; the reservo the solution also W73-02 W73-02811

PROSPECT ALONG SEMIPALA MY (PERS ZEMNYKH TYSH'YA V Akademiya stitut Gidrog S. M. Mukh Tlekin In: Region ledovaniya Kazakhskoy

Gidrofiziki 7 3 fig, 2 tab, 1 Descriptors: *Groundwat bility, Groun riers, Base teristics, W chemistry, 1 level fluctus Geologic tim Identifiers:

Mineralizatio

WATER QUANTITY MANAGEMENT AND CONTROL-Field 04

Groundwater Management—Group 4B

Descriptors: "Hydrogeology, "Groundwater, "Groundwater resources, "Groundwater availability, "Projections, Water requirements, Water supply, Water utilization, Water consumption (Except consumptive use), Water types, Industrial water, Municipal water, Irrigation water, Irrigation tion, Agriculture. Identifiers: *USSR, *Kazakhstan, Mineralization.

The supply of groundwater in Kazakhstan is 7.7 trillion cu m, of which 5.6 trillion cu m is artesian water. The volume of annually renewable ground-water is 38 billion cu m. Maximum groundwater storage is concentrated in southern Kazakhstan storage is concentrated in southern Kazakhstan where geologic and hydrogeologic conditions are favorable for the use of groundwater in irrigation, pasture inundation, and for municipal, industrial, and agricultural water supplies. Availability fresh and weakly saline groundwaters is projected for each of the 15 administrative regions of the Republic together with recommended groundwater withdrawals to meet the needs of the national economy in 1976-80. (See also W73-02809). (Josefson-USGS)

ROLE OF GROUNDWATER IN MAINTAINING THE LEVEL OF LAKE BALKHASH (ROL'
PODZEMNYKH VOD V PODDERZHANII
UROVNYA OZ. BALKHASH),
Akademiya Nauk Kazakhakoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki.
U. M. Akhmedsafin.

O. M. Aklinieusain. In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstane; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 27-30, 1971.

Descriptors: "Hydrogeosogy, "Groundwater, *Lakes, "Water levels, Water level fluctuations, Irrigation, Irrigation water, Irrigation design, Reservoir construction, Planning. Identifiers: "USSR, "Kazakhstan, "Lake Balk-

The possibility of maintaining the level of Lake Balkhash at optimal depths was investigated in connection with construction of the Kapchagay Reservoir and design of large irrigation structures in lower reaches of the Ili River. Specific proposals include extensive use of groundwater to compensate for inadequate surface-water sup-plies; reduced application of irrigation water to rice fields; increase in the time period for filling the reservoir; and a sound, scientific approach to the solution of water management problems. (See also W73-02809) (Josefson-USGS)

PROSPECTS OF USING GROUNDWATERS ALONG THE IRTYSH RIVER NEAR SEMIPALATINSK IN THE NATIONAL ECONO-MY (PERSPEKTIVY ZEMNYKH VOD SEMIPALATINSKOGO PRIIR-Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki.
S. M. Mukhamedzhanov, F. K. Kabiyev, and S. T.

Tlekin.

Ireani. In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstane; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 62-79, 1971. 3 fig, 2 tab, 13 ref.

Descriptors: *Hydrogeology, *Groundwater, *Groundwater resources, *Groundwater availability, Groundwater recharge, Groundwater baronity, Groundwater recharge, Groundwater bar-riers, Base flow, Aquifers, Aquifer charac-teristics, Water types, Water analysis, Water chemistry, Water quality, Water levels, Water level fluctuations, Water supply, Water wells, Geologic time, Estimating. Identifiers: *USSR, *Kazakhstan, *Irtysh River,

Hydrogeologic work was initiated in 1964 for determination and appraisal of groundwater resources along the right bank of the Irtysh River near Semipalatinsk in northeastern Kazakhstan. A brief Semipassunsk in nortneastern a zaknstan. A orner description is given of the water-bearing formations in the area together with estimates of groundwater availability. Regional estimates of usable groundwater storage indicate that groundwater can be an important source of industrial and controlled the state of the st agricultural water supply. (See also W73-02809) (Josefson-USGS)

MINERAL WATERS ALONG THE EASTERN MINERAL WALERS
THE CASPIAN LOWLAND
(MINERAL'NYYE VODY VOSTOCHNOY
OKRAINY PRIKASPIYSKOY VPADINY),

Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-stitut Gidrogeologii i Gidrofiziki. M. A. Mukhamedzhanov, I. B. Dal'yan, N. E. Zeyberlikh, and Zh. S. Sydykov.

zeyoetiikh, and z.h. S. Sydykov. In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstane; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 103-107, 1971. I tab, 3 ref.

Descriptors: "Mineral water, "Water types, "Water quality, "Water chemistry, Salts, Gases, Springs Human pathology. Identifiers: "USSR, "Caspian Sea, "Mineral springs, Spas, Balneology, Mineralization.

Depending upon balneological properties, mineral Depending upon balacological properties, mineral waters along the eastern edge of the Caspian Lowland are divided into 5 groups: (1) strongly saline (38.4-270.5 glitter) sodium-chloride waters in Upper Carboniferous, Lower and Upper Permain, and Lower Triassic deposits; (2) moderately saline (4.3.7.4 editors) sodium solvents upon the saline stress in University of Stress positives begins upon the saline stress in University and Stress positives begins upon the saline stress in University and Stress positives begins upon the saline stress in University and Stress positives begins upon the saline stress in University and Stress positives begins upon the saline stress in University and Stress and S (4.3-7.4 g/liter) sodium-chloride waters in Upper Permian and Middle Jurassic deposits; and (3), (4), and (5) weakly saline (1.4-4.1 g/liter) waters of various constitutents in Lower Cretaceous sandy deposits. The waters are similar to those of mineral springs of many famous spas and can be used at local health resorts in the treatment of disease. (See also W73-02809) (Josefson-USGS) W73-02813

WATER RESOURCES OF THE USPENSKIY MINING DISTRICT AND A TECHNICAL AND ECONOMIC JUSTIFICATION OF THEIR USE (VODNYYE RESURSY USPENSKOGO RUD-NOGO POYASA I TEKHNIKO-EKONOMICHESKOYE OBOSNOVANIYE IKH

ISPOL'ZOVANIYA), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-

Akademiya Nauk Kazakiskoj SSK, Alma-Ata, Institut Giforgologii i Gidrofiziki.
S. M. Shapiro, N. D. Petrov, and Ye. M. Upushev.
In: Regional'nyve gidrogeologicheskiye issledovaniya v Kazakhstane; Akademiya Nauk
Kazakhskoy SSR Institut Gidrogeologii i
Gidrofiziki Trudy, Vol 4, Alma-Ata, p 114-123,
1971. 1 fig, 15 ref.

Descriptors: *Water resources, *Water utilization. Descriptors: "water resources, "Water utilization, 'Surface waters, "Groundwater, "Mining, Indus-tries, Agriculture, Economics, Economic justifica-tion, Water types, Water supply, Water consump-tion (Except consumptive use), Water require-ments, Water quality, Water wells. Identifiers: "USSR, "Kazakhstan, "Mining districts, *Mineralization.

Groundwater and surface waters were investigated in the Atasu, Uspenskiy, and Karagayly regions of the Uspenskiy mining district in the Karaganda Oblast in Kazakhstan for economic projections of industrial-water requirements. Annual consumption of water in the district is 32.6 million cu m, of which about 69% is consumed by agricultural activities and 31% by industry and the community. Water from underground sources (representing over 70% of the available water supply) and surface-water supplies can be used in existing mining industries of the area or in those under construction. (See also W73-02809) (Josef-son-USGS)

MONITORING GROUNDWATER RESERVOIRS IN PIEDMONT PLAINS OF TIEN SHAN (UPRAVLENIYE REZHIMOM PODZEMNYKH VOD NA PREDGORNYKH RAVNINAKH TYAN'

SHANYA), Akademiya Nauk Kazakhakoi SSR, Alma-Ata. Institut Gidrogeologii i Gidrofiziki.
U. M. Akhmedsafin, V. F. Shlygina, and F. V.

Snestakov.

In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstane; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 138-147, 1971. 2 fig, 4 tab, 19 ref.

*Groundwater, Descriptors: *Groundwater resources, *Groundwater recharge, *Artificial recharge, Groundwater mining, Discharge (Water), Base flow, Water levels, Water level fluctuations, Water storage, Aquifers, Mountains, Alluvial fans, Geology, Hydrogeology, Economics, Equations.
Identifiers: *USSR. *Kazakhstan. *Tien Shan.

*Piedmont plains, Geography.

Geographic, geologic, hydrogeologic, and economic conditions affecting artificial ground-water replenishment in piedmont plains of the Tien Shan mountain system in southern and southeast-ern Kazakhstan are investigated. The Tien Shan plains exemplify conditions favorable for artificial groundwater recharge. The specific purposes for which artificial recharge is recommended are to supplement the rapidly diminishing supplies of groundwater and to reduce the decline in the water level of groundwater reservoirs. (See also W73-02809) (Josefson-USGS) W73-02815

OCCURRENCE OF GROUNDWATER IN THE PIEDMONT ALLUVIAL PLAIN ON THE NORTHERN SLOPE OF DZUNGARIAN ALA TAU (FORMIROVANIYE PODZEMNYKH VOD PREDGORNOGO SHLEVFA SEVERNOGO SKLONA DZHUNGARSKOGO ALATAU), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-

stitut Gidrogeologii i Gidrofiziki. G. G. Oshlakov.

In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstane; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 170-174, 1971. 2 tab. 8 ref.

Descriptors: *Groundwater, *Water balance, *Water supply, *Mountains, *Slopes, Alluvial fans, Rivers, Runoff, Surface runoff, Subsurface flow, Base flow, Precipitation (Atmospheric), Evaporation, Irrigation, Equations. Identifiers: *USSR, *Kazakhstan, *Piedmont allu-

vial plains, Depressions (Geologic), Water-balance

Groundwater in piedmont alluvial plains is an important source of water supply for population centers and agricultural enterprises in Kazakhstan and Soviet Central Asia. Subsurface flow from the northern slope of the Dzungarian Ala Tau range is estimated to be 29.31 cu m/sec, increasing in the piedmont plain to 83.65 cu m/sec. The main sources of groundwater in the plain are streamflow (38%) and subsurface flow from the mountains (35%). Other sources of groundwater include water from irrigation canals (11%), precipitated moisture (9%), and water from irrigated fields (7%). (See also W73-02809) (Josefson-USGS) W73-02816

Field 04-WATER QUANTITY MANAGEMENT AND CONTROL

Group 4B-Groundwater Management

GROUNDWATER OF THE AKDALA RIVER VALLEY AND PROSPECTS OF ITS USE AS A WATER-SUPPLY SOURCE (PODZEMNYYE VODY DOLINY R. AKDALA I PERSPEKTIVY IKH ISPOL'ZOVANIYA DLYA VODOSNABZ-HENIYA), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-

stitut Gidrogeologii i Gidrofiziki. A. F. Kalmykov.

In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstane; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 206-209,

Descriptors: *Groundwater, *Confined water, *Water supply, Aquifers, Aquifer characteristics, Properties, Water quality, Water requirements, Water wells, Withdrawal, Exploitation, Rivers, Valleys, Geologic time.

Identifiers: *USSR, *Kazakhstan, *Mineraliza-

Groundwater is an important source of water supply in the Akdala River valley in the northeast-ern part of the Betpak-Dala Desert in Kazakhstan. Groundwater of the valley is confined to Neogene Quaternary sand and gravel deposits composed of two water-bearing horizons situated at depths of 1.65-5.1 m and 62-96 m, respectively. Water can be drawn from the upper horizon from large-diameter wells due to a depth of 10-15 m and from the lower horizon from wells dug to a depth of 100 m. The thickness of the aquifers and the chemical quality of the groundwaters are examined in connection with recommendations for the effective exploitation of these waters to satisfy the water requirements of industry and agriculture. (See also W73-02809) (Josefson-USGS) W73-02817

UNDERGROUND MINERAL WATER OF AL-PINE REGIONS OF SOUTHEASTERN UNDERGROUND MINERAL WATER OF AL-PINE REGIONS OF SOUTHEASTERN KAZAKHSTAN (PODZEMNYYE MINERAL'-NYYE VODY VYSOKOGORNYKH RAYONOV YUGO-VOSTOCHNOGO KAZAKHSTANA), Akademiya Nauk Kazakhskoi SSR, Alma-Ata. In-stitut Gidrogeologii i Gidrofiziki.

M. S. Kan. M. S. Aan. In: Regional'nyye gidrogeologicheskiye iss-ledovaniya v Kazakhstane; Akademiya Nauk Kazakhskoy SSR Institut Gidrogeologii i Gidrofiziki Trudy, Vol 4, Alma-Ata, p 210-222, 1971. 2 fig. 6 tab

Descriptors: "Mineral water, "Water quality,
"Water chemistry, "Water properties, "Alpine,
Mountains, Springs, Salts, Gases, Trace elements,
Iron, Silica, Thermal water, Human pathology.
Identifiers: "USSR, "Kazakhstan, "Silicon,
"Radon," Mineralization, Balneology, Spas.

Depending upon water-quality characteristics, mineral waters of alpine regions of Kazakhstan, including large mountain structures of northern Tien Shan, Dzungarian Ala Tau, Altay, and Saur-Tarbagatay ranges, are divided into 4 balneological groups: (1) waters without specific constituents of properties; (2) radon-bearing waters; (3) silicon-bearing thermal waters; and (4) iron-bearing waters. The possibility of exploitation of these waters and their subtypes for therapeutic purposes is examined together with the factors responsible for anomalous concentrations of trace con-stituents in them. (See also W73-02809) (Josefson-USGS) W73-02818

THE RECIPROCITY PRINCIPLE IN FLOW THROUGH HETEROGENEOUS POROUS THROUGH

MEDIA,
G. A. Bruggeman.
In: Fundamentals of Transport Phenomena in
Porous Media; International Association for
Hydraulic Research, Developments in Soil

Science 2, New York, N Y, Elsevier Publishing Company, p 136-149: 1972. 5 fig.

Descriptors: *Drawdown, *Hydrogeology, *Groundwater movement, *Artesian aquifers, Mathematical studies, Aquifers, Aquichudes, Aquitards, Porous media, Soil water movement. Identifiers: *Netherlands.

In the southwest deltaic area of the Netherlands, a horizontal layered formation consists of two leaky aquifers, separated and confined by semipervious strats. The drawdown distribution of the piezometric head in the upper aquifer, as a result of draining the lower aquifer by means of a steady well, equals the drawdown distribution in the well, equals the drawdown distribution in the lower aquifer, caused by pumping the upper aquifer with the same discharge. This reciprocity of drawdown and discharge is shown to be a general principle. (Knapp-USGS) W73-02827

WATER REQUIREMENTS OF SANTA BAR-BARA COUNTY, 1967 TO 1990, Bookman and Edmonston, Glendale, Calif. For primary bibliographic entry see Field 06D. W73-02868

POLLUTION STUDIES OF THE REGIONAL OGALLALA AQUIFER AT PORTALES, NEW MEXICO, Eastern New Mexico Univ., Portales. Dept. of

Biological Sciences.
For primary bibliographic entry see Field 05B. W73-02891

AN ECONOMIC ANALYSIS OF WATER-USE REGULATION IN THE CENTRAL OGALIALA FORMATION,

Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics. H. P. Mapp, Jr.

Ph.D. Dissertation, May 1972. 324 p. 14 fig. 44 tab. 88 ref.

Descriptors: *Water allocation, *Economic effi-*Soil-water-plant relationships, *Progressive taxes, Irrigation water, Farm management, Computer models, Simulation analysis, Well regu-lations, Irrigation practices. Identifiers: *Ogallala Formation.

This study is an economic analysis of the impact of Into study is an economic analysis of the impact of alternative methods of water-use regulation on representative farms overlying the Central Ogal-lala Formation. Two means of restricting water-use were compared to the current policy of unuse were compared to the current poncy of un-restricted pumping. A firm simulation model was used in the analysis. The unique feature of the model is the production subset which calculates daily soil moisture values throughout the growing season and computes yield as a function of soil moisture and atmospheric stress during the stages of plant development for each crop. One method of restriction placed a limit of 1.5 acre feet on the amount of water that can be pumped annually per acre of water rights. The second method of limit-ing water use assumes a tax of \$6.00 per acre foot is imposed on the water pumped in excess of 1.5 acre feet per acre of water rights. In general, placing a limit on the amount pumped was more effec-tive in reducing the amount of water used, but it also resulted in reduced net farm income and net worth. Imposing the tax was not as effective in reducing the amount of water used, but it did result in more efficient water use. It also resulted in after-tax net farm income as great or greater than unrestricted pumping. W73-02892

SHALLOW AQUIFERS RELATIVE TO SUR-FACE WATERS, NORTH PLATTE RIVER VAL-LEY, GOSHEN COUNTY, WYOMING, Wyoming Univ., Laramie. Dept. of Geology.

Ph D Thesis, June 1972, 194 p, 29 fig, 9 tab, 104 ref, 9 append. OWRR A-009-WYO (1).

Descriptors: "Wyoming, "Withdrawal, Water table aquifers, Water levels, "Groundwater movement, "Alluvial aquifers, Aquifer management, Model studies, Water wells.
Identifiers: "Platte River Valley (Wyo).

The study of the groundwater situation in the Lower North Platte Valley, Goshen County, Wyoming was undertaken to determine water table position and safe yield within the alluvial aquifer under varying conditions of discharge and recharge. Safe withdrawal levels are based on reasonable estimates of flow into and through the alluvial aquifer. Suggestions relative to proper management of the water resource result from the W73-02900

DEVELOPMENT OF GROUND-WATER RESOURCES IN THE ORANGE COUNTY AREA, TEXAS AND LOUISIANA, 1963-71, Geological Survey, Austin, Tex. R. K. Gabrysch, and G. D. McAdoo. Texas Water Development Board Report 156, August 1972. 47 p. 10 fig. 7 tab., 18 ref.

Descriptors: *Groundwater resources, *Water resources, "Water level fluctuations, "Texas, Lou-siana, Withdrawal, Pumping, Water supply, Water demand, Water yield, Water quality, Chemical analysis, Aquifer characteristics, Hydrologic data, Data collections. Identifiers: *Orange County area (Tex and La).

The principal water-bearing units in the Orange County area, Texas and Louisiana, are the Chicot and Evangeline aquifers. The lower unit of the Chicot, which yields about 21 mgd is the principal source of groundwater. The upper unit of the Chicot yields about 2 mgd. The Evangeline aquifer, which contains fresh water in southern Jasper and Newton Counties and northern Orange nty, Texas is undeveloped in the report are County, 18km is unneveloped in the report area.
Although pumpage of groundwater increased by only about 12% (2.4 mgd) from 1962 to 1970, water levels have declined. During this period, the decline ranged from 10 to 20 feet, and the maximum rate of decline was about 2.8 feet per year. Subsidence of the land surface due to lowering of artesian pressure has been generally less than 0.5 foot since 1918. Analyses of consolidation tests of clay in the Houston area in conjunction with studies of hydrologic conditions in Orange County in-dicate that water levels could probably be lowered an additional 75 feet before aignificant subsidence would occur. (Woodard-USGS) W73-03139

LOCATION OF WELLS AND TEST HOLES. HARTFORD NORTH QUADRANGLE, CON-Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-03153

4C. Effects on Water of Man's Non-Water Activities

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN AREA, 1970, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W73-02652

THE NAT DEPOSITS MINING (Geological S For primary W73-02661

URBAN SEI Geological S For primary W73-02793

EROSIONA HARVESTI Forest Serv Southwest F For primary W73-02957

THE IMPAC THE ECOL Texas A and For primary W73-03068

ANNUAL C HYDROLOG IN THE METROPOL Geological S For primary W73-03148

A SURVEY LOGGING (ISLAND STE Fisheries Re (British Colu Technical Re 12 tab. 20 ref

Descriptors: pollution effe temperature. tries, Water ment, Salmo Aquatic hab lands, Baland Bank erosion Identifiers: *!

Comparisons tebrate drift. channel widt streams secti in standing ti numbers or v as high in the Jump Creek. logged section mental factor differences p perature in the W73-03160

4D. Water

AN APPLIC ANALYSIS IN Colorado State Resources Cer For primary bi W73-02873

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants-Group 5A

THE NATURE AND EXTENT OF PEAT DEPOSITS AND POSSIBLE EFFECTS OF PEAT DEPUSITS AND PUSSIBLE EFFECTS OF FRAT MINING ON MANMADE FEATURES AND SPRINGS NEAR MESCALERO, NEW MEXICO, Geological Survey, Albuquerque, N.Mex. For primary bib. ographic entry see Field 04B. W73-02661

URBAN SEDIMENTATION -- IN PERSPECTIVE, Geological Survey, Reston, Va. For primary bibliographic entry see Field 02J. W73-02793

EROSIONAL CONSPOUENCES OF TIMBER HARVESTING: AN APPRAISAL, Forest Service (USDA), Glendora, Calif. Pacific Southwest Forest and Range Experiment Station. For primary bibliographic entry see Field 02J. W73-02957

THE IMPACT OF WATER DEVELOPMENT ON THE ECOLOGY OF RIVER SYSTEMS, Texas A and M Univ., College Station. For primary bibliographic entry see Field 05B. W73-03068

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO, METROPOLITAN AREA, 1970, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W73-03148

A SURVEY OF SOME POSSIBLE EFFECTS OF LOGGING ON TWO EASTERN VANCOUVER ISLAND STREAMS, Fisheries Research Board of Canada, Nanaimo

(British Columbia).

D. W. Narver. Technical Report No. 323, July 1972. 55 p, 11 fig, 12 tab. 20 ref.

Descriptors: *Lumbering, *Clear-cutting, *Water pollution effects, *Environmental effects, *Water temperature, *Stream erosion, *Canada, Industries, Water pollution sources, Forest management, Salmon, Trout, Water quality, Habitats, Aquatic habitats, Wildlife conservation, Frail Bank erosion, Degradation (Stream), Streams.
Identifiers: *British Columbia.

Comparisons are made of fish populations, invertebrate drift, stream temperatures and stream channel widths in recently clearcut and burned streams sections and adjacent upstream sections in standing timber. Jump Creek and Wolf Creek are considered. The standing stock of trout by numbers or weight per unit area was about twice as high in the timbered as in the logged section of Jump Creek, but the average size of trout in the logged section was greater. The definitive environmental factors are not clearly understood, but the differences possibly relate to higher water temperature in the logged areas. (LeGore-Washington) W73-03160

4D. Watershed Protection

APPLICATION OF MULTI-VARIATE ANALYSIS IN HYDROLOGY, Colorado State Univ., Fort Collins. Environmental Resources Center. bibliographic entry see Field 02E. W73-02873

ECONOMIC EFFICIENCY VS. ENVIRONMENTAL QUALITY IN SMALL WATERSHED DEVELOPMENT,

Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics. W. Miller, and D. Byers.

(1972), 15 p, 1 fig, 1 tab, 8 ref. OWRR B-042-IND

Descriptors: "Watersheds (Basin), "Watershed management, "Economic efficiency, "Environmental effects, Benefits, Linear programming, Mathematical models, Water resources develop-Identifiers: Watershed development

A linear programming model is developed for in-vestigating the trade-off between the objectives of economic efficiency and environmental quality in the Soil Conservation Service small watershed program. The model's objective is to maximize net ational benefits subject to certain constraints on environmental quality. The model places major emphasis upon defining the relationship between emphasis upon defining the relationship between the economic efficiency components of the en-vironmental quality objectives. In order to ex-amine a specific watershed planning problem, the West Boggs Creek Watershed in southern Indiana was selected for a case study. Eleven components of the watershed environment were chosen for study in the empirical model. However, only the relationship between per national benefits and the relationship between net national benefits and the non-game bird component of environmental quali-ty is discussed in detail. A non-game bird trade-of-function was derived. It indicates a range over which the economic efficiency and environmental quality objectives were not competitive. As the economically optimum combination of land management was established by the model, it was noted that the number of non-game birds in the watershed was substantially increased. However, beyond this level, increasing dollar sacrifices of net national benefits were required in order to add more birds. (Settle-Wisconsin)

EROSIONAL CONSEQUENCES OF TIMBER HARVESTING: AN APPRAISAL, Forest Service (USDA), Glendora, Calif. Pacific Southwest Forest and Range Experiment Station. For primary bibliographic entry see Field 02J. W73-02957

PEDIMENTS AND TERRACES ALONG THE MOAPA VALLEY, CLARK COUNTY, NEVADA, South Carolina Univ., Columbia. Dept. of Geolo-

For primary bibliographic entry see Field 02J. W73-03146

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR COW BAYOU, BRAZOS RIVER BASIN, TEXAS, 1970, Geological Survey, Austin, Tex. For primary bibliographic entry see Field 07C. W73 03147

05. WATER OUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

IDENTIFICATION OF TOXIC COMPONENTS IN OIL REFINERY EFFLUENTS AND DETER-MINATION OF THEIR EFFECT UPON THE AQUATIC BIOTA, Oklahoma Water Resources Research Center,

Stillwater T. C. Dorris, S. L. Burks, M. R. Curd, G. R. Waller, and L. D. Broemeling.

Available from the National Technical Informa-tion Service as PB-213 493, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Sep-tember 1972. 113 p., 47 fig. 8 tab, 18 ref. OWRR B-017-OKLA (1) 14-31-0001-3321.

Descriptors: "Toxicity, "Bioassay, Toxins, "Organic compounds, Gas chromatography, "Mass spectrometry, "Flash evaporation, Copper, Zinc, Lead, Nickel, Cadmium, Chromium, Activated carbon, Solvent extraction, Minnows, "Heavy metals, "Analytical techniques, Water pollution effects.

Identifiers: *Oil refinery effluents, *Atomic absorption, *Daphnia magna, *Pimephales promelas.

Carbon adsorption, solvent extraction, steam distillation and flash evaporation techniques were used to remove organic fractions from oil refinery ents. Toxicity of organic fractions was eval ated by bioassay with fathead minnows (Pimephales promelas) and Daphnia (Daphnia magna). Demonstrably toxic fractions were subjected to gas chromatography and combination gas chromatography mass spectrometry analyses. Concentrations of toxic heavy metals in the refinery effluents were analyzed by atomic absorption spectrophotometry. The flash evapora-tion technique removed most of the acute toxins from the effluent samples. Compounds tentatively identified were cresol, dimethyl phenol or ethyl phenol, heneicosane, docosane, tricosane, and pentacosane. The flash evaporation extracts con-tained many other compounds which have not yet been identified. The concentration of toxic heavy metals in the effluent samples was generally below published 48 hour LC50 values and it was concluded that no single heavy metal caused acute toxicity. The combined concentration of several of the heavy metals could be deleterious to aquatic organisms. W73-02609

WATER RESOURCES OF THE MINNESOTA RIVER--HAWK CREEK SOUTHWESTERN MINNESOTA, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-02663

ENVIRONMENTAL MONITORING REPORT: JULY-DECEMBER 1971 AND 1971 SUMMARY, Mound Lab., Miamisburg, Ohio. For primary bibliographic entry see Field 05B. W73-02709

WEST VALLEY REPROCESSING PLANT. EN-VIRONMENTAL REPORT NO. 11, 2ND HALF Nuclear Fuel Services, Inc., West Valley, N.Y. For primary bibliographic entry see Field 05B. W73-02712

TRITIUM IN INVESTIGATION OF SURFACE HYDROLOGY. EXPERIMENTAL DETERMINA-TION OF COEFFICIENT OF RUNOFF, Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research. For primary bibliographic entry see Field 05B. W73-02713

INSTRUCTION MANUAL FOR OIL SLICK IDENTIFICATION BY TRACE ELEMENT PAT-TERNS MEASURED WITH NEUTRON ACTIVA-Gulf Radiation Technology, San Diego, Calif.

H. R. Lukens. Available from NTIS, Springfield, Va., as GULF-RT-A-10973; \$3.00 in paper copy, \$0.95 in microfiche. Report GULF-RT-A-10973, May 1972. 74 p, 1 fig, 9 tab, 2 ref. AEC-AT (04-3)-167.

Group 5A-Identification of Pollutants

Descriptors: *Pollutant identification, *Neutron Descriptors: Frontant neutrineaton, Actation activation analysis, "Oil spills, Water pollution sources, Sampling, Standards, Analytical techniques, *Trace elements, Gamma rays, Spectrometers, Radioactivity techniques, Probability.

Methodology is given for matching an oil sample (about 5 ml or less) with its source. The develop-ment of this method was reported earlier (GA-9889, 1970; GULF-RT-A10864, 1971). Probabili-9889, 1970; GULF-RT-A10864, 1971). Probabilistics of accurate matching versus the degree of agreement for the more commonly encountered trace elements (S, In, Br, Mn, Ni, I, Ga, As, Co, CI, Al, Zn, Na, Dy) are given. The standard used for normalization of the neutron exposure was usually V for short exposures, arsenic for long exposures. (Bopp-ORNL) W73-02715

ENVIRONMENTAL MONITORING IN THE VICINITY OF THE LOS ALAMOS SCIENTIFIC LABORATORY, JULY THROUGH DECEMBER

Los Alamos Scientific Lab., N. Mex. For primary bibliographic entry see Field 05B. W73-02719

CONTEMPORARY SOURCES GEOCHEMISTRY OF TRITIUM IN THE GULF MEXICO AND ITS DISTRIBUTIVE PROVINCE,

Texas A and M Univ., College Station. For primary bibliographic entry see Field 05B. W73-02730

PROCEEDINGS OF SOUTHERN CONFERENCE PROCEEDINGS OF SOUTHERN CONFERENCE,
ON ENVIRONMENTAL RADIATION PROTECTION FROM NUCLEAR POWER PLANTS,
APRIL 21-22, 1971.
Environmental Protection Agency, Washington,
D.C. Office of Radiation Programs.
For primary bibliographic entry see Field 05B.

W73-02732

EVALUATION OF ENVIRONMENTAL FAC-TORS AFFECTING POPULATION EXPOSURE, Battelle-Pacific Northwest Labs., Richland, Wash.

For primary bibliographic entry see Field 05B. W73-02733

THE TERRESTRIAL RADIOLOGICAL MONI-TORING PROGRAMS AT DUKE POWER COM-PANY'S OCONEE AND MCGUIRE NUCLEAR STATIONS, Duke Power Co., Charlotte, N.C.

For primary bibliographic entry see Field 05B. W73-02735

APPLICATION OF CF252 TO THE DETECTION OF HEAVY METALS FOR POLLUTION CON-

TROL, Gulf Radiation Technology, San Diego, Calif.

Gulf Radiation Technology, San Diego, Calif. J. John, and V. J. Orphan.
Transaction available from American Nuclear Society, Inc., 244 E Ogden, Hinsdale, Ill. 60521. \$25.00/copy. In: Transactions of American Nuclear Society, 1972 Annual Meeting, June 18-22, 1972, Las Vegas, Nevada, Vol 15, No 1, p 66-67, 1972. 1 fig, 1 tab.

Descriptors: *Monitoring, Streams, Sediments, *Sampling, Water sampling, *Heavy metals, Mea-surement, *Radioactivity, Instrumentation, *Pol-lutant identification, Pollution abatement. Identifiers: Radiation safety, *Radiation control.

The detection and measurement of heavy metals in sediment and water samples from inland water-ways are essential to understanding environmental pollution problems. The feasibility of a Cf252based neutron activation analysis (NAA) system suitable for monitoring the trace metal contamination of the environment has been studied. Labora-tory experiments were performed using a 24-microgram Cf252 source and an 80-cm3 Ge (Li) detector. Irradiation and counting times were limited, in most cases, to 10 minutes. Based on these experiments, detection limits have been calculated for several elements for a system using 5 mg of Cf252. These are compared, where possible, to values obtained by others for a system using 10 mg of Cf252 and two 12.7-x 12.7-cm NaI (TI) detectors. (Houser-ORNL) W73-02738

ENVIRONMENTAL SAMPLING FOR RIVER SEDIMENTS AROUND A NUCLEAR POWER STATION, New York Univ., N.Y. Inst. of Environmental Medicine.

For primary bibliographic entry see Field 05B.

ENVIRONMENTAL RADIOACTIVITY MEA-SUREMENT EXPERIENCE NEAR A FUELS REPROCESSING PLANT, New York State Dept. of Environmental Conser-

vation, Albany.
For primary bibliographic entry see Field 05B. W73-02741

ENVIRONMENTAL RADIATION DOSIMETRY NEAR LARGE NUCLEAR POWER STATIONS. New York Operations Office (AEC), N. For primary bibliographic entry see Field 05B. W73-02742

ECOLOGICAL TECHNIQUES UTILIZING RADIONUCLIDES AND IONIZING RADIA-TION. A SELECTED BIBLIOGRAPHY, Washington State Univ., Pullman. Dept. of Zoolo-

For primary bibliographic entry see Field 05B. W73-02746

FEASIBILITY STUDY OF THE APPLICATION OF SOLVENT EXTRACTION AND GAS-LIQUID PARTITION CHROMATOGRAPHY MARINE TRACE METAL ANALYSIS, Alaska Univ., College. Inst. of Marine Science.

M-L., Lee. Available from NTIS, Springfield, Va., as RLO-2229-T1-12; \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-2229-T-1-12, April 1972. 75 p, 15 fig, 20 tab, 30 ref. AEC AT (45-1)-2229.

Descriptors: *Water analysis, *Gas chromatography, *Chelation, *Solvent extractions, Feasibility studies, *Trace elements, Reviews, Aluminum, Iron, Zinc, Cobalt, Analytical techniques, Research and development, Instrumentation, Sea water. Identifiers: Indium.

Chromatography of the trifluoroacetylacetone chelate in toluene gave a sensitivity of about 6 picogram for Al in natural waters, but was unsuccessful for very small traces of In, Fe, Zn or Co, both from absorption loss in the chromatographic column and from chelate decomposition. The use of glass beads as a chromatographic support material may be more successful. Extraction of trace In, Fe, Zn, Co, and Al from seawater by toluene-trifluoroacetyl acetone was efficient over a wide pH range. Direct chromatography of the extract was feasible since toluene did not interfere with electron-capture detection of the trifluoroacetylacetone chelate. (Bopp-ORNL) W73-02747 ORIGIN OF MANGANESE NODULES OF THE PACIFIC OCEAN FROM RADIOISOTOPE DATA,
Akademiya Nauk SSSR, Moscow. Geologicheskii

Institut. For primary bibliographic entry see Field 05B. W73-02752

EVALUATION OF ION-EXCHANGE SURVEIL-LANCE SAMPLER FOR ANALYZING RADIOACTIVE LIQUID EFFLUENTS, Bureau of Radiological Health, Cincinnati, Ohio. Radiological Engineering Lab. H. L. Krieger, and G. W. Frishkorn. Health Physics, Vol 21, p 591-595, Oct. 1971. 3 fig,

Descriptors: "Nuclear wastes, "Analytical techniques, "Monitoring, "Ion exchange, "Path of pollutants, Effluents, Sampling, Radiochemical analysis, Water analysis, Radioactivity techniques, On-site investigations, Rivers.

Radiochemical analyses are normally performed on aliquots of 500 ml or less for the picoCi/ml range; however, larger samples are required for the lower levels in reactor effluents. Ion-exchange was used for concentration of 200-liter samples of was used for concentration of 200-liter samples of water with 250 ppm hardness, and for even larger volumes of softer water. Cs137, Sr85, Co60, and II31 were almost completely sorbed by the uppermost section of cation- or anion-exchange resins. They were eluted with 6 N HCl and were determined radiochemically and by gamma spectrometry. (Bopp-ORNL) W73-02753

TRACE-METAL ASSOCIATIONS IN SUB-A-RTIC AND ARCTIC MARINE ENVIRONMENTS
- PROGRESS REPORT, JUNE 1971-MAY 1972,
Alaska Univ., Fairbanks. Inst. of Marine Science. For primary bibliographic entry see Field 05B. W73-02754

AIR POLLUTION FROM COMBUSTION PRODUCTS,
Joint Labs. of the Electric Utilities in the Netherlands, Arnhem.
For primary bibliographic entry see Field 05C.
W73-02771

A STUDY ON THE CHEMICAL BEHAVIOR OF ZINC IN CHESAPEAKE BAY WATER USING ANODIC STRIPPING VOLTAMMETRY, Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst. For primary bibliographic entry see Field 05B. W73-02783

WATER RESOURCES DATA FOR GEORGIA---1971. Geological Survey, Atlanta, Ga. For primary bibliographic entry see Field 07C. W73-02784

DEVELOPMENT OF ANALYTICAL FOR PROCEDURES DETERMINING CHLORINATED HYDROCARBON RESIDUES IN WATERS AND SEDIMENTS FROM STORAGE RESERVOIRS, Bureau of Reclamation, Denver, Colo. E. T. Lyons, and H. A. Salman. Bureau of Reclamation Report REC-ERC-72-15,

April 1972, 6 p, 1 map, 3 tab, 17 ref.

Descriptors: *Water analysis, *Chemical analysis, Descriptors: "Water analysis, "Chemical analysis, "Pesticide residues, "Detection, "Chlorinated hydrocarbon pesticides, Gas chromatography, Water sampling, Sediments, Reservoirs, Water quality, Pesticides, Insecticides, Water storage, Quantitative analysis, Qualitative analysis,

Bibliographi techniques. Identifiers:

Analytical n chlorinated and bottom extraction v matography using 6% die by florisil cl the most rep secticides in sediment sar into the gas the insectici and correcte methods, wa Mead were The water sa tration of 0.0 other insect were found in matograph in extremely d (USBR)

THE COD MANAGEMI AND CONCI Army Engine For primary W73-02869

CODORUS VESTIGATION Pa. Region II For primary 1 W73-02870

POLLUTION SEA WATER JAPANESE), Chiba Univ. (For primary b W73-02928

DETERMINA

CADMIUM I TION SPEC DITHIOCAR KETONE EX OUS PHASE Hiroshima U Y. Yamamoto Kanke. J Hyg Chem. Identifiers: *Cadmium, Methylisobut trophotometr

aspirating the nonium chelating ager phase obtaine smaller volum added because methyl isobut solvent effect much enhance of Cd.-Copyr W73-02939

A trace amou

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants-Group 5A

Bibliographies, On-site investigations, Analytical techniques.

Identifiers: Lake Mead. Test results. Sediment

Analytical methods for measuring and detecting chlorinated hydrocarbon insecticides in reservoir and bottom muds are described. A semiautomatic extraction with hexane followed by gas chro-matography was used to determine the presence of insecticides in water. A 16-hr soxhlet extraction using 6% diethyl ether in petroleum ether followed by florisil cleanup and gas chromatography gave the most reproducible results for determining insecticides in bottom muds. For both water and secticities in bottom must. For both water and sediment samples, a known volume was injected into the gas chromatograph, the concentration of the insecticide determined by comparing their peak heights with those of insecticide standards, and corrected for percent of recovery. Using these methods, water and sediment samples from Lake Mead were analyzed for numerous insecticides. mples contained lindane at a concentration of 0.02 to 5.00 parts per billion (ppb). No other insecticides were found. No insecticides were found in the sediments; however, gas chromatograph interferences made sediment analysis extremely difficult even after column cleanup. W73-02844

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY, SUMMARY REPORT

Army Engineer District, Baltimore, Md. For primary bibliographic entry see Field 05G. W73-02869

CODORUS CREEK WATER QUALITY IN-VESTIGATION REPORT, Environmental Protection Agency, Philadelphia,

Pa. Region III. nary bibliographic entry see Field 05G. For primary W73-02870

POLLUTION BY COLIFORM BACTERIA IN SEA WATER OF SWIMMING RESORTS: II (IN JAPANESE), Chiba Univ. (Japan). Chiba Sch. Pharm. Assoc.

For primary bibliographic entry see Field 05B.

DETERMINATION OF A TRACE AMOUNT OF CADMIUM IN WATER BY ATOMIC ABSORP-TION SPECTROPHOTOMETRY COMBINED WITH AMMONIUM PYRROLIDINE DITHIOCARBAMATE-METHL ISOBUTYL KETONE EXTRACTION USING LARGE AQUE-OUS PHASE/SOLVENT RATIOS, Hiroshima Univ. (Japan). Faculty of Science.

Y. Yamamoto, T. Kumamaru, Y. Hayashi, and M. Kanke

J Hyg Chem. Vol 17, No 4, p 251-254. 1971. Illus. Identifiers: Ammonium, *Aqueous solutions, *Cadmium, Carbamate, Extraction, Ketone, Methylisobutyl, Pyrrolidine, Solvents, *Spec-trophotometry, Trace elements.

A trace amount of Cd (ppb) was determined by aspirating the methyl isobutyl ketone extract using nonium pyrrolidine dithiocarbamate as a chelating agent. When a large aqueous phase/solvent ratio was used, the volume of the organic phase obtained after extraction decreased to a smaller volume compared with the initial volume added because of the appreciable solubility of methyl isobutyl ketone in water. In addition to the solvent effect, this 'solubility effect' resulted in much enhanced sensitivity for the determination of Cd.—Copyright 1972, Biological Abstracts, Inc. W73-02939 DETERMINATION OF TOTAL MERCURY IN SLUDGE (IN JAPANESE), Chiba Univ. (Japan). Faculty of Pharmaceutical

Sciences. Y. Yamane, M. Miyazaki, K. Sakai, N. Murakami,

J Hyg Chem. Vol 17, No 4, p 274-279, 1971. Illus. English summary. Identifiers: *Dithizone method, Japan, *Mercury,

Sludge, Pollutant identification.

The dithizone method for determination of Hg in JIS K 0 102 (Testing Methods for Industrial Waste Water) was improved for the determination of total Hg in sludge. In the improved method, the sludge was decomposed in HNO3-KMnO4 medium using an apparatus described in the Standard Methods for Hygenic Chemists in place of the JIS decomposition bottle. Recovery of Hg from the sludge added with C2H5HgCl was 91.2%, and was nost quantitative. Application of this method for the determinations of total Hg in sludges obtain sea at Ichihara Industrial Area was fairly satisfactory. The average recovery rate of Hg was 99.6%, and the deviation was within 10%.—Copyright 1972, Biological Abstracts, Inc. W73-02945

PRODUCTION OF GEOSMIN AND 2-EX-O-HYDROXY-2-METHYLBORNANE BY STREPTOMYCES ODORIFER,
Connecticut Univ., Storrs. Biological Sciences

Group. R. P. Collins, L. E. Knaak, and J. W. Soboslai. Lloydia, Vol 33, No 1, p 199-200, 1970. EPA Project 16040 DGH.

Descriptors: *Actinomycetes, Chemical properties, *Odor, Bacteria, Analytical techniques, Pollutant identification, Gas chromatography, *Spec-

trophotometry.

**Geosmin,

**Geosmin, Identifiers: *Earth-m Streptomyces odorifer.

The major odorous constituents produced by Streptomyces odorifer have been identified as geosmin and 2-exo-hydroxy-2-methylbornane. The compounds were isolated from culture filtrates and identified by gas-chromatography, infrared and mass spectroscopy. (EPA abstract) W73-02949

A SYSTEM FOR THE RAPID ANALYSIS OF ORGANIC PHOSPHORUS IN WATER SAM-PLES OR FRACTIONS FROM CHROMOATO-GRAPHIC COLUMNS,

Guelph Univ. (Ontario). Dept. of Land Resource Science

Communications in Soil Science and Plant Analysis, Vol 3, No 5, p 351-354, 1972. 2 fig, 3 ref.

Descriptors: *Analytical techniques. Phosphorus, *Sampling, Chemical analysis, *Chromatography, Pollutant identification. Identifiers: Autoanalysis, *Organic phosphorus,

Perchloric digestion.

In previous determinations of organic phosphorus in large numbers of water samples, the column effluent in which samples are fractionated by various chromatographic techniques must be continuously monitored or large numbers of fractions individually analyzed. Procedures are given for phosphorus analysis permitting rapid analysis of large numbers of fractions or samples with a minimum of sample handling. The key to minimizing sample manipulation is to select equipment that permits interchange of test tubes on the fraction collector and the AutoAnalyzer. Samples collected from columns are analyzed directly for inorganic phosphorus on the Technicon AutoAnalyzer using an ammonium molybdate and ascorbic acid ction procedure with a namifold. An elution pattern obtained using this procedure gives an accuracy quite adequate for determining these pat-terns and for bulking samples for further analysis. Since each fraction is usually only slightly dif-ferent from the next, it is sufficient to analyze only every fourth or fifth tube, depending on column size and sample concentration. This procedure permits rapid preparation of an elution pattern and eliminates time consuming steps such as pipetting aliquots, adding reagents, and measuring optical densities that are normally required. (Jones-

COMPILATION OF WATER QUALITY DATA AND PARAMETERS FROM KANSAS RIVERS AND STREAMS, Kansas State Univ., Manhattan. Inst. for Systems

Design and Ontimization

. T. Fan, S. H. Lin, J. J. Lizcano, K. P. Radha

Krishnan, and C. L. Hwang. Kansas Water Resources Research Institute, Manhattan. Contribution No 109, July 1972. 97 p, 11 fig, 8 tab, 32 ref. OWRR B-021-KAN (4) and B-030-KAN (1).

Descriptors: *Documentation, *Basic data collections, *Water quality, *Kansas, *Rivers, *Streams, Hydrologic data, Temperature, Descriptors: "Documentation, "Basic data collections, "Water quality, "Kansas, "Rivers, "Streams, Hydrologic data, Temperature, Biochemical oxygen demand, Dissolved oxygen, Flow rates, Depth, Velocity, Reaeration, Photosynthesis, Respiration, Dispersion.

The water quality data, parameters, and hydrology of Kansas streams and rivers are compiled as source information for constructing mathematical models relevant to the water quality control and water resource management. Planning and development for water resources management and water quality control necessitate an appraisal of the location, availability and reliability of water sources such as lakes, rivers, reservoirs, ground water, industrial and agricultural waste, municipal effluents, etc. The water quality data are classified according to physical, chemical, and biological parameters. Hydrologic data that represent stream characteristics such as mean depth, mean width. mean velocity and runoff are listed. Data sources on each parameter are listed in the references column and also summarized and classified in the bibliographic section. Parameters of special interest to system analysis and modeling of water quality are: stream temperature, BOD concentration, DO concentration, stream flow rate, stream depth, stream velocity, deoxygenation coefficient, natural reaeration coefficient, photosynthesis minus respiration, and dispersion coefficient. The characteristics of these parameters and variables of rivers and streams of Kansas are analyzed and discussed. (Jones-Wisconsin) W73-02973

WHAT WATER AND WASTE WATER PARAMETERS SHOULD WE MEASURE, Wapora, Inc., Rockville, Md. Water Quality Programs. S. Megregian.

American Institute of Chemical Engineers Symposium Series, Water--1971, p 478-479

Descriptors: *Water pollution control, *Waste water (Pollution), *Parametric hydrology, Water quality, Measurement, Monitoring, Data collections, *Ohio, Pollutant identification. Identifiers: Water pollution parameters, *Cincinnati (Ohio).

A problem solving approach in selection of parameters to be measured in waste-water process control is needed. It is often better to take more data than may seem necessary rather than limit programs only to those parameters having specific immediate usefulness. Deciding potential values of data requires understanding and experience. Three case histories are discussed. One of these, initiated in 1937 by the Public Health Service Water Pollu-

Group 5A-Identification of Pollutants

tion Control division and operating from Cincinnati, was to encompass all categories of measurement on as broad a scale as possible to develop basic data for evaluation of water quality trends. The first year saw 50 sampling stations established and an analytical program covering chemistry, bacteriology, radiochemistry, persistent organic chemicals, and planktonic organisms. Sampling and analyses were mainly carried out on a weekly to monthly basis. An off-shoot of this program was the first attempt to screen the waters for stronting the program of these contents and for trace metals. All of these un-90 content and for trace metals. All of these data are now being used for various purposes by the pollution control agencies. Any measurement program should have a continuous mechanism for monitoring accuracy of test results which would provide statistical data on precision/accuracy. (Jones-Wisconsin) W73-02976

METHODS FOR THE CHARACTERIZATION OF SUSPENDED SEDIMENT AND SELECTED APPLICATIONS FOR THE ACQUIRED DATA, Battelle-Pacific Northwest Labs., Richland, Wash.

nary bibliographic entry see Field 05B. W73-02977

A C-14 ASSAY FOR PHOTORESPIRATION IN

AQUATIC PLANTS, Michigan State Univ., Hickory Corners. Dept. of Botany and Plant Pathology. For primary bibliographic entry see Field 05C. W73-02978

SCRUBBED DIESEL EXHAUST FOR CARBON DIOXIDE ENRICHMENT OF GREENHOUSE

Arizona Univ., Tucson. Environmental Research Lab. For primary bibliographic entry see Field 03F. W73-03074

A MOBILE LABORATORY FOR MONITORING ENVIRONMENTAL POLLUTION (IN

Istituto Superiore di Sanita, Rome (Italy). F. Ugolini. ITALIAN),

Ann Ist Super Sanita, Vol 7, No 1, p 67-78, 1971, Illus, English summary. Identifiers: Air, *Environmental pollution, *Mo-

bile laboratories, *Monitoring, Water pollution, Soil.

A special mobile laboratory, equipped with instru-mentation necessary to monitor the pollution of air, water and soil was successfully used for over 1 yr in various areas of Italy. The vehicle does not have fixed instrumentation, but has the basic equipment necessary for the installation of different instruments which vary according to the particular monitoring required.—Copyright 1972, Biological Abstracts, Inc. W73-03108

METHOD FOR DETERMINING NUMBER OF BACTERIA IN OOZE DEPOSITS OF WATER

RESERVOIRS (IN RUSSIAN), V. I. Romanenko, and V. A. Romanenko. Mikrobiologiya, Vol 40, No 5, p 912-915, 1971, Il-

lus, English summary.
Identifiers: "Bacteria, Deposits, Method, "Ooze,
"Reservoirs, USSR, Pollutant identification.

A direct method for bacterial count by preparing A direct method for bacterial count by preparing microsamples of ooze is described. A drop of 0.05% agar-agar is added to the sample (5-15 mg), mixed and distributed on a definite glass area. The preparation is dried, fixed in absolute alcohol and stained with erythrosin. The results, obtained by pour method and by the Vinogradsky-Germanov technique of dilutions, coincided. The bacterial

number in the Rybinsk (U.S.S.R.) water reservoir during May-November 1969 was ca. 1.4 10 to the 9th power per 1 g of wet ooze. The lowest number was detected in June-0.8 10 to the 9th power, the highest number was registered in August-Sep-tember-2.3 10 to the 9th power.—Copyright 1972, Biological Abstracts, Inc. W73-03115

REMOTE SENSING OF ENVIRONMENTAL

POLLUTION, Geological Survey, Washington, D.C. G. W. North.

Proceedings available from GPO, Washington, D. Proceedings available from OPO, washington, D. C. 20402 Price \$5.25. In: Proceedings International Workshop on Earth Resources Survey Systems, May 3-14, 1971, Washington, D.C., Vol 2, p 291-301, (1971). 1 fig.

Descriptors: *Remote sensing, *Pollutant identifi-cation, *Aerial photography, *Satellites (Artifi-cial), Photogrammetry, Water pollution sources, Path of pollutants, Air pollution, Environment, Ecology, Analytical techniques, Instrumentation, Water quality control, Reviews, Conferences.

Through the use of remote sensing systems and techniques, it is possible to detect, identify, measure, and study the effects of various environmental pollutants. As a guide for making decisions regarding the use of remote sensors for pollution studies, a special five-dimensional sensor/applications matrix was designed. The matrix defines an environmental goal, ranks the various remote sensing objectives in terms of their ability to assist in solving environmental problems, lists the enin solving environmental problems, lists the environmental problems, ranks the sensors that can be used for collecting data on each problem, and finally ranks the sensor platform options that are currently available. (Woodard-USGS) W73-03131

REMOTE SENSING OF WATER POLLUTION, TRW systems, Redondo Beach, Calif. R. G. White.

Proceedings available from GPO, Washington, D.C. 20402 Price \$5.25. In: Proceedings International Workshop on Earth Resources Survey Systems, May 3-14, 1971, Washington, D.C., Vol 2, p 303-321, (1971). 13 fig.

Descriptors: *Remote sensing, *Water pollution sources, *Aerial photography, Analytical techniques, Photogrammetry, Instrumentation, Pollutant identification, Oil spills, Thermal pollu-tion, Sewage effluents, Algae, Reviews, Con-

Remote sensing, as a tool to aid in the control of water pollution, may prove to be exceptionally valuable in the next few years. It offers a means of making rapid, economical surveys of areas that are relatively inaccessible on the ground. At the same relatively inaccessible on the ground. At the same time, it offers the only practical means of mapping pollution patterns that cover large areas. New sensors and techniques, under development for the past several years, will obtain information about the nature and extent of pollution that previously could only be obtained by water sampling. Some of these sensors operate in daylight only, while others will work either day or night. Data are presently being obtained from aircraft in conjunction with analyses of water samples taken on the tion with analyses of water samples taken on the ground to correlate the airborne data with such ground to correlate the auroone data with such parameters as sediment count, algae concentration and type, degree of thermal pollution, and oil slick extent and thickness. Figures show the regions of the electromagnetic spectrum of most interest in this type of remote sensing. Detection of oil slicks, thermal pollution, sewage and algae are discussed. (Woodard-USGS)

FRAUNHOFER LINE-DEPTH SENSING AP-PLIED TO WATER, Geological Survey, Washington, D.C. G. E. Stoertz.

G. E. Stoertz.

Available from NTIS, Springfield, Va 22151 as N72-18451, Price \$3.00 paper copy; \$0.95 microfiche. Geological Survey-National Aeronautics and Space Administration Interagency Report NASA-158, 1969. 43 p. 5 fig. 1 tab, 5 ref.

Descriptors: *Remote sensing, *Water quality, *Instrumentation, *Aircraft, Turbidity, Estuaries, Bays, Analytical techniques, Water pollution sources, Light intensity, Tracking techniques, Dye releases.

An experimental Fraunhofer Line Discriminator (FLD) is basically an airborne fluorometer, capable of quantitatively measuring the concentration of fluorescent substances dissolved in water. It of theorescent substances dissolved in water. It must be calibrated against standards and supplemented by ground-truth data on turbidity and on approximate vertical distribution of the fluorescent substance. Quantitative use requires fluorescent substance. Quantitative use requires that it be known in advance what substance is the source of the luminescence emission. Qualitative sensing, or detection of luminescence is also possible. The two approaches are fundamentally different, having different purposes, different applications, and different instruments. When used for sensing of Rhodamine WT dye in coastal waters and estuaries, the FLD is sensing in the spectral region permitting nearly maximum depth of light penetration. It should be nearly optimum for sensing in turbid estuaries such as Chesapeake Bay or San Francisco Bay. (Woodard-USGS) W73-03140

A SIMPLE TECHNIQUE FOR DETECTING EF-A SIMPLE IELINIQUE PUR BEIEL INVESTEESES ON A PREDATOR-PREV INTERACTION, Savannah River Ecology Lab., Aiken, S.C. For primary bibliographic entry see Field 05C. W73-03161

AN APPROACH TO THE PROBLEM OF POL-LUTION AND FISHERIES,

Department of the Environment Stevenage (England). For primary W73-03163 nary bibliographic entry see Field 05C.

BIOLOGIC PARAMETERS IN WATER TRANS-MISSION OF VIRUSES, New Hampshire Univ., Durham, Dept. of

Microbiology. T. G. Metcalf.

11. U. Metchil.
In: Virus and Water Quality: Occurrence and Control, Proceedings, Thirteenth Water Quality Conference, Elinois Univ., Urbana-Champaign, p 1-16, Feb 15-16, 1971. 1 fig, 3 tab, 70 ref.

Descriptors: *Water treatment, *Water quality, *Public health, Sanitary engineering, *Viruses, Diseases, Epidemics, E. Coli, Analytical techniques, Bioindicators.

Enteric viruses represent a unique biologic parameter of public health concern involved in considerations of water quality. Viruses capable of considerations of water quanty. Virtues capable of inducing human infections occur frequently in raw sewage and their removal from wastewaters may pose serious technical problems. Opportunities for human infections follow exposure to enteric virtues in surface waters following their release in raw sewage or treated effluents. A water transmission route has been proposed for a number of severe gastrointestinal infections of viral etiology. The most prominent of these is infectious hepatitis. Virus survival on land or in water is a function of virus identity or environmental and seasonal influences. Prolonged survival is known to occur when enteric viruses find shelter in dor-mant shellfish. Bacterial pollution indicators are

unsatisfac virus poll subject to teric virus physical p nucleic ac properties used to sin of this gre W72-13610 W73-03173

DETECTION REVIEW (Gulf Coas Ala. W. F. Hill, In: Virus a trol, Proce ference, II 46, Feb 15-

Descriptor *Water qui techniques Adsorption Centrifuga Identifiers:

cinally to t

dard methodow multiple of water. T to the need techniques likelihood been shows for assessir types of wa (1) membra tion to prec trolytes; (c) technique. good-to-exc well as a r viruses form ultracentrifu sis and elec have also sh cies under virus-in-wat appear that tecting and clean and fi virus adsort flow-through 03173) (Bear W73.03174) W73-03174

PROCEERS APPARATU VIRUSES WATER, Baylor Coll. Virology and C. Wallis.

In: Virus and trol, Proceed ference, Illin 49, Feb 15-16 Descriptors:
*Public healt
Polyelectroly

tion, Resins. Identifiers: A Poliovirus a recovered eff

unsatisfactory for monitoring the occurrence of virus pollution, and bacteriophage indicators are subject to question. The biological activities of en-teric viruses are a function of the chemical and physical properties displayed by their capsid and nucleic acid structures. Bacteriophages displaying properties similar to enteric viruses have been d to simulate the biologic behavior of mer of this group in water quality studies. (See also W72-13610 and W73-03174 thru W73-03178) W73-03173

DETECTION OF VIRUSES IN WATER: A REVIEW OF METHODS AND APPLICATION, Gulf Coast Water Hygiene Lab., Dauphin Island,

Ala.

W. F. Hill, Jr., E. W. Akin, and W. H. Benton.

In: Virus and Water Quality: Occurrence and Control, Proceedings, Thirteenth Water Quality Conference, Illinois Univ., Urbana-Champaign, p 17-46, Feb 15-16, 1971. 1 fig, 7 tab, 71 ref.

Descriptors: *Water treatment, *Public health. *Water quality, Sanitary engineering, *Analytical techniques, *Viruses, Polyelectrolytes, Polymers, Adsorption, Electrophoresis, Electro-osmosis, Centrifugation, Membranes, Filters, Flocculation. Identifiers: Hydroextraction.

One major problem facing environmental health officials in regard to water quality is related principally to the unavailability of reliable and standard methods to concentrate, detect, and isolate dard methods to concentrate, detect, and isolate low multiplicities of virus from very large volumes of water. The challenge to the virologist is related to the need for developing new and/or improved techniques in the laboratory that have a high likelihood for adaptation to the real world situa-tion. In this regard, a number of techniques have been shown experimentally to be good candidates for assessing the occurrence of visues in various been shown experimentary to be good candinates for assessing the occurrence of viruses in various types of water. The most promising methods are:

(1) membrane-adsorption technique; (b) adsorption to precipitable salts, iron oxide, and polyelectrolytes; (c) aqueous polymer two-phase separation technique; and (d) soluble alginate filter technique. Most of these methods have shown conditionated and the second transcellant views recovery. efficiencies as recanque. Most of these methods neve shown good-to-excellent virus recovery efficiencies as well as a reasonable efficacy for concentrating viruses form water in controlled laboratory experiments. Other methods such as (1) continuous-flow ultracentrifugation, (b) forced-flow electrophore-sis and electroosmossis, and (c) hydroextraction have also shown favorable virus recovery efficiences under laboratory-controlled conditions but fall short as candidate techniques for real world virus-in-water problems. From the data, it would appear that the most promising methods for detecting and isolating low multiplicities of virus in clean and finished waters are those that relay on virus adsorption and/or retention coupled with a flow-through sampling system. (See also W73-03173) (Bean-AWWARF) cies under laboratory-controlled conditions but W73-03174

PROGRESS IN THE DEVELOPMENT OF AN APPARATUS FOR CONCENTRATION OF VIRUSES FROM LARGE VOLUMES OF WATER

Baylor Coll. of Medicine, Houston, Tex. Dept. of Virology and Epidemiology. C. Wallis.

In: Virus and Water Quality: Occurrence and Control, Proceedings, Thirteenth Water Quality Conference, Illinois Univ., Urbana-Champaign, p 47-49, Feb 15-16, 1971. 4 ref.

Descriptors: *Water treatment, *Water quality, *Public health, *Analytical techniques, *Viruses, Polyelectrolytes, Polymers, Adsorption, Filtration, Resins. Identifiers: Amberlite.

Poliovirus added to raw tap water can be recovered efficiently by the procedure described.

Water is first passed through clarifiers which water is the passed unough ciarriers which remove the non-viral contaminants in the follow-ing sequence: through ciarriying filters of porosi-ties of 10u, 5u, 3u, and 1u to remove particulate matter, and then through a 1-u cotton textile filter to electrostatically remove the ferric compounds.

The water is next passed through a special amberlite resin to remove other soluble salts and fine silts which are not removed by textile filters, and the clean water containing the virus is driven through a virus adsorbent. The compound MgCl2 is added to enhance the concentration of virus on cellulose membranes, or CO2 is added to concentrate the virus on an insoluble polyelectrolyte layer. Water could be processed at the rate of 300 gal per hour (GPH) with virus recovery efficiencies ranging from 61 to 84 percent. (See also W73-03173) (Bean-AWWARF) W73-03175

CONCENTRATION OF VIRUSES BY OSMOTIC ULTRAFILTRATION: A PRELIMINARY RE-PORT ON THE DEVELOPMENT OF A MODEL

SYSTEM, Gulf South Research Inst., New Orleans, La. Public Health Science Div.
B. H. Sweet, E. Klein, R. Ellender, F. C. Morton,

ln: Virus and Water Quality: Occurrence and Control, Proceedings, Thirteenth Water Quality Conference, Illinois Univ., Urbana-Champaign, p 51-55, Feb 15-16, 1971. 2 tab, 11 ref.

Descriptors: *Water treatment, Water quality, Public health, *Analytical techniques, Viruses, Polyelectrolytes, Adsorption, Filtration. Identifiers: *Ultrafiltration.

The osmotic ultrafiltration system has shown excellent capabilities for concentrating large volumes of virus-containing waters for subsequent analysis by tissue culture techniques. The results of studies with poliovirus in the model system indicate the potential usefulness of the technique. Currently, the limitations of the system are being analyzed. (See also W73-03173) (Bean-AWWARF) W73-03176

VIRUS-SIZED PARTICLE ADSORPTION ON SOIL-PART I: RATE OF ADSORPTION, Oregon State Univ., Corvallis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.

METHYL MERCURY ACETATE FROM WATERS BY CHROMATOGRAPHY ON CHELATING POLYMERS, Bologna Univ. (Italy). Ciamician Chemical Inst. R. A. A. Muzzarelli, and A. Isolati. Water Air Soil Pollut. Vol 1, No 1, p 65-71. 1971.

Illus. Identifiers: Acetate, Chitosan, Chromatography, Dowex, *Mercury, Polymers, Sea water, Spectrometry, *Separation techniques.

Chitin, chitosan and Dowex A 1 chelating polymers powders, 100 to 200 mesh, were used in column chromatography to remove methyl mercury acetate from various waters, including sea water and a dilute acetic acid-acetaldehyde solu tion. Methyl mercury acetate was labeled with 203Hg and chromatography was followed by gamma-ray spectrometry. Results show that chitosan and Dowex A I are particularly effective in collecting Hg, even though the metalorganic compounds are not fixed so strongly as the simple ions. Elution can be performed with hot water. A good volume reduction factor can be obtained and the results might be applied in Hg pollution prevention.—Copyright 1972, Biological Abstracts, Inc.

ENVIRONMENTAL GEOCHEMISTRY IN HEALTH AND DISEASE.
For primary bibliographic entry see Field 05B.
W73-03196

GROUP ANALYSIS OF IMPURITIES IN RE-CALIMED WATER (IN RUSSIAN), V. A. Kryuchkov.

V. A. Kryuchkov. Kosm Biol Med. Vol 5, No 4, p 21-26, 1971, Illus.

(English summary). Identifiers: *Water reuse, *Water quality, Impuri-ties, Reclaimed water, Liquid wastes.

Impurities which may contaminate reclaimed water from human liquid wastes were analyzed. The reclamation procedure and the composition of contaminants disagreed with standard norms. contaminants disagreed with standard norms. Criteria for appraising the quality of reclaimed water were developed and a method for estimating total contamination based on group parameters was devised. Application of the method in assessing the water quality is described and new problems related to water regeneration are discussed.—Copyright 1972, Biological Abstracts, W73-03246

5B. Sources of Pollution

MICROBIAL MODIFICATION OF GROUND

WATER,
Illinois Univ., Urbana. Water Resources Center.
R. P. Gunsalus, J. G. Zeikus, and R. S. Wolfe.
Available from the National Technical Information Service as PB-213 500, 33.00 in paper copy, en 94 in microfiche. Illinois Water Resources 80.95 in microfiche. Illinois Water Resources Center Research Report No 57, August 1972. 38 p, 10 fig, 7 tab, 13 ref. OWRR A-038-ILL (1). 14-31-0001-3213.

Descriptors: Groundwater, Wells, Water pollution sources, *Methane, *Bacteria, *Illionis, Pollutant identification, *Microbial degradation, Air-water interfaces.

Identifiers: *Microbial floc.

When ground water is tapped by wells, microbial and chemical deposits often develop. Sloughing and clogging may occur in the distribution system adding considerable expense to the operation of the water systems as well as imparting taste and odor to the water itself. The physical and microbial flocs found in Southern Illinois as a 'model system.' These flocs proliferate at the air-water interface of a domestic flush tank producing copious amounts of flocculent material. Observation of the flocs by phase microscopy revealed a dense population of bacteria with several distinct morphological types. Analysis by scanning and transmission electron microscopy revealed that the floc members reside in a matrix and that the consortium consists of two ultrastructurally distinct types of bers reside in a matrix and that the consortium consists of two ultrastructurally distinct types of bacteria, Results of chemical analysis of the well water indicated low levels of organic material, whereas results of gas chromatographic analysis indicated high amounts of methane were present in the water. The predominant organism, and elipsoidal rod, was isolated from floc enrichments grown under a methane-air atmosphere. Two organisms of a second morphological cell type have also been isolated and their unique nutritional properties investigated. A number of heterotrophic organisms have also been isolated from the consortium and cross-feeding experiments involving mixed consortium cultures revealed a microbial food chain exists with methane as the primary energy source. energy source. W73-02602

TRANSPORT PROCESSES OF PARTICLES IN DILUTE SUSPENSIONS IN TURBULENT WATER FLOW - PHASE II, Illinois Univ., Urbana. Water Resources Center. For primary bibliographic entry see Field 08B.

Group 5B-Sources of Pollution

W73-02605

THE OCCURRENCE AND POSSIBLE SOURCE OF THE COLIFORM BACTERIA ON THE SHORELINE OF NORTHERN LAKE MICHIGAN.

Michigan State Univ., East Lansing. Dept. of Microbiology and Public Health. W. N. Mack, and C. L. Dekker. Available from the National Technical Informa-

Available from the National Technical Informa-tion Service as PB-213 503, \$3.00 in paper copy, \$9.95 in microfiche. Institute of Water Research, Michigan, Project Completion Report, November, 1972, 25 p., 6 fig. 3 tab, 12 ref. OWRR B-020-MICH (1) 14-31-0001-3598.

Descriptors: *Coliforms, *Bacteria, *Lake Michigan, *Water pollution sources, Water pollution, Water quality. Identifiers: Pleasure watercraft, *Non-point source pollution.

During studies on the presence of coliform bac-teria in a marina used by pleasure watercraft in northern Lake Michigan, it was determined that there were more coliform organisms present in the water than could be accounted for by the presence of the watercraft. This resulted in a study to determine the source of these organisms. Samples of water were collected from thirteen rivers and creeks draining the 12-mile beach study area. All the streams flowing into Lake Michigan contained coliform bacteria. In general, those streams draining remote areas contained more coliform bacteria than streams draining populated areas. The organ-isms washed into Lake Michigan from the streams accumulated along the beach but very few organ-isms were recovered as little as 1000 feet out into the lake from the shoreline. There is a need to know more about the significance of this organism in water, since it is used as an index of biological pollution. W73-02606

MERCURY POLLUTION OF GOLF COURSE

LAKES, Missouri Water Resources Research Center,

S. R. Koirtyohann, R. Meers, K. Graham, and B. Bassett

Bassett.
Available from the National Technical Informa-tion Service as PB-213 508, \$3.00 in paper copy, \$0.95 in microfiche. Missouri Water Resources Research Center Completion Report, August 20, 1972. 25 p, 5 fig, 2 tab, 7 ref, 7 append. OWRR A-054-MO (1). 14-01-0001-3525.

Descriptors: *Mercury, *Water pollution sources, *Golf courses, *Water pollution effects, *Lakes, Fungicides, *Missouri, Bioindicators, *Bass.

The pollution of lakes on golf courses from mercurial fungicides used in greens treatment was stu-died. Golf courses near Columbia, Kansas City, St. Louis, and New Bloomfield, Mo., were selected for study. Several lakes with no known source of mercury contamination were sampled for background data. Several species of fish as well as water, algae, and bottom sediments sam-ples were collected from each lake. Mercury was ples were collected from each lake. Mercury was determined by a flameless atomic absorption method. The results indicate that there can be significant pollution of lakes on golf courses from the greens treatment, especially if organically bound mercury is used in the treatment. The flesh of mature large-mouth basis is the most sensitive indicator. Bass taken from golf course lakes contain 1-7 micros of mercury per gram of wet tissue, dependmicrog of mercury per gram of wet tissue, depend-ing on size and other factors. Background mercury levels in bass are 0.1-1 micro/g. Many lakes with no known source of mercury contamination produce mature bass which contain significantly more mercury than the 0.5 ppm recommended by the FDA as the maximum for human food. Smaller bass generally contain less mercury.

APPLICATION OF BIOLOGICAL MONITOR-ING SYSTEMS TO SIMULATED INDUSTRIAL WASTE DISCHARGE SITUATIONS, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. For primary bibliographic entry see Field 05C. W73-02617

IMPROVING WATER QUALITY BY REMOVAL OF PESTICIDE POLLUTANTS WITH AQUATIC PLANTS, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Plant Pathology and Physiology. For primary bibliographic entry see Field 05G. W73-02621

GROUNDWATER FLOW IN PARTIALLY

GROUNDWATER FLOW IN PARTIALLY SATURATED SOILS, Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
M. C. Wang, and V. A. Nacci.
Available from the National Technical Information Service as PB-213 458, \$3.00 in paper copy, \$0.95 in microfiche. Rhode Island Water Resources Center Completion Report, August 10, 1972. 73 p. 18 fig. 11 ref. 2 append. OWRR A-036-RI (1). 14-31-0001-3240.

Descriptors: *Base flow, *Model studies, *Mathematical studies, *Path of pollutants, *Groundwater, Soils, Wells, Water pollution, Leaching, Soil disposal fields, Computer programs.

The rate of seepage from a disposal field to a water supply source is dependent upon soil parameters and hydraulic conditions. Until the development of the high speed digital computer, the solution of the problem of superimposing an infiltration area on groundwater flow was too complicated by analytical and graphical methods. Therefore a computer program based upon the finite element principle was developed to solve the problem of groundwater seepage toward a well with vertical infiltration from the ground surface. The computer solution was verified by model study. The relationships among such parameters as the time of ships among such parameters as the time of seepage from a pollutant source to a well and the spacing between the well and source were established for various soil and boundary conditions. W73-02624

PERIPHYTON AND PHYTOBENTHON AS IN-DICATORS OF WATER QUALITY, Rhode Island Univ., Kingston. Water Resources

R. D. Wood, J. Mallett, and L. Ventura. Available from the National Technical Informa-tion Service as PB-213 459, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, 1972. 42 p., 3 fig. 20 tab, 13 ref. OWRR B-026-RI (1). 14-31-0001-3328.

Descriptors: *Periphyton, *Bioindicators, Pollu-tant identification, Water quality, Algae, Diatoms, Correlation analysis, Succession, Rivers, *Rhode Island, Industrial wastes, Textiles, Scenedesmus, Water pollution sources.

In three Rhode Island rivers, sets of upstream-downstream stations from industrial pollution sources were investigated for annual trends in chemical-physical factors, hydrology, and plant biota. Periphyton of 1-,2-, and 4-week-immersed glass slides was the main type sample, but epipelic, attached benthic, and macrophyte plants were also sampled. Correlation coefficients were computed among the factors, and correlations among predominate taxa as well as among them and the factors are in preparation. Of over 150 microalgal species, nine sensitive to textile mill effluents were detected. Of these Scenedesmus dimorphus and S. quadricauda when present at these stations were indicators of mill pollution. W73-02625

DIFFUSION OF THERMALLY BUOYANT WATER JETS INTO A MOVING WATER STREAM, Rhode Island Univ., Kingston. Dept. of Mechanical Engineering and Applied Mechanics. F. L. Test, and W. M. Hagist. Available from the National Technical Information Service as PB-213 461, 33.00 in paper copy, \$0.95 in microfiche. Rhode Island Water Resources Center Completion Report, 1972. 28 p, 8 fig, 2 ref. OWRR B-028-RI (2). 14-31-0001-3329.

Descriptors: "Thermal pollution, Water pollution sources, *lets, *Diffusion, *Open channel flow, Streams, *Path of pollutants, *Turbulent flow. Identifiers: *Heated jets.

An experimental investigation of a turbulent, two-dimensional, heated slot jet was conducted. Mean velocity profiles and turbulent intensities were ob-tained for unheated jets and mean temperature profiles were obtained for heated jets. Two angles of jet injection were used with a wide range of velocity ratios. An integral method was developed velocity ratios. An integral method was developed to predict the trajectory, spreading, velocity decay and temperature decay of a two-dimensional heated jet. The solution worked well for both the 90 deg injection angle and 30 deg upstream injection angle, even though the profiles vary from the assumed distributions for the 30 deg case in the early stages of jet development. The program yields good overall prediction of jet behavior. W73-02627

CONTROL OF MERCURY POLLUTION IN SEDIMENTS.
Robert S. Kerr Water Research Center, Ada,

For primary bibliographic entry see Field 05G. W73-02632

DISPERSION OF CONTAMINATED BED-LOAD

PARTICLES, Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

Engineering. H. W. Shen, and H. F. Cheong. Research Report, 1971. 22 p, 12 fig, 2 tab, 6 ref. OWRR B-041-COLO (4), Grant GK11499 NSF, OWRR 14-01-0001-1435.

Descriptors: *Sediment transport, *Water pollu-tion sources, *Alluvial channels, *Uniform flow, *Stochastic processes, Particle size, Mathematical studies, Equations, Model studies, Analytical techniques, Curves, Steady flow, Flow rates, Forecasting, Identifiers: *Contaminated sediment particles.

Investigations were made on the downstream effects of an instantaneous injection of contaminated sediment particles at a given locality in a straight alluvial stream with steady uniform flow. The analysis is based on the stochastic model of sediment dispersion of Yang and Sayre (1971) wherein the shape parameter of the Gamma distributed step lengths is allowed to vary from 1 o.3. The distribution is initially highly skewed and becomes progressively symmetrical with time so that it can be approximated by a Gaussian curve. The location of the peak advances slightly faster than the mass center and they are almost coin-Ine location of the peak advances slightly faster than the mass center and they are almost coincident after a long time has elapsed. A simplified procedure of approximating the envelope of the family of distribution curves for a specified run yields a curve that is uniformly lower than the envelope. (Woodard-USGS) W73-02650

BIBLIOGRAPHY ON HANDLING, CONTROL AND MONITORING OF TRITIUM (DEC. 1968-JAN. 1972), Mound Lab., Miamisburg, Ohio. B. J. Hannahs, and C. J. Kershner. Report No MLM-1946, Sept. 5, 1972. 44 p, 2 in-

Descriptors:
*Tritium, * *Tritium, * Control, Re Water pollut

An annotate purpose of p relating to th tritium. Part needs of the nited States period cover raphy was fi cludes both j and author plicability of format was (Houser-OR W73-02708

ENVIRONM JULY-DECE Mound Lab. D. G. Carfag Available fro port No. ML tab, 6 ref, ap

Descriptors: ment, *Efflu plants, Nucl Water pollut Water pollut Identifiers: I The environ

was monitor of 1971 and include air, radioactive s were well w by the Aton vironmental nonradioacti presented for that Mound effect on the on sampling ous radionuc W73-02709

RADIOACT NORTHEAS OCEAN, Akademiya Hidrofizychi I. P. Bakshee Markelov, at Available fro 55743; \$3.00 Okeanologiy Dec. 1971, 4

Descriptors: Ocean, *Ass pollution, W Path of poll Air pollutio

Artificial rad

the northeas Strontium-90 the beginning ues for th 50 disintegra water layer. radioactive p served nort Hebrides and fragments re dustrial atom

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Sources of Pollution-Group 5B

Descriptors: "Bibliographies, "Publications, "Tritium, "Monitoring, "Radioactivity, "Assay, Control, Regulation, Public health, Air pollution, Water pollution, Soil contamination.

An annotated bibliography was prepared for the purpose of providing a collected source of information on recent literature available on subjects relating to the control, monitoring, and handling of tritium. Particular emphasis was placed on literature that relates to the tritium handling and control needs of the Division of Military Applications/United States Atomic Energy Commission. The period covered in the preparation of this bibliography was from 1968 to January 31, 1972, and includes both journal and report literature. Keyword and author indexes are provided for general apcludes both journal and report lie attree. Reyword and author indexes are provided for general ap-plicability of this document and a subject grouping format was followed in arranging the references. (Houser-ORNL) W73.02708

ENVIRONMENTAL MONITORING REPORT:

JULY-DECEMBER 1971 AND 1971 SUMMARY, Mound Lab., Miamisburg, Ohio. D. G. Carfagno, and W. H. Westendorf. Available from NTIS, Springfield, Va., as MLM-1922; \$3.00 in paper copy, \$0.95 in microfiche. Report No. MLM-1922, May 22, 1972. 42 p, 3 fig, 16 tab, 6 ref, append.

Descriptors: "Monitoring, "Surveys, "Measure-ment, "Effluents, "Radioisotopes, Nuclear power-plants, Nuclear wastes, Pollutants, Air pollution, Water pollution, Soil contamination, Food chains, Water pollution sources.
Identifiers: Polonium, Plutonium.

The environment surrounding Mound Laboratory was monitored and reported on for the second half of 1971 and for the entire year. Samples analyzed include air, water, foodstuffs, soil and silt. For radioactive species the average concentrations of radioactive species the average concentrations of polonium-210, plutonium-218, and tritium detected were well within the stringent standards adopted by the Atomic Energy Commission and the Environmental Protection Agency. Data concerning nonradioactive species in air and water are presented for the first time. These data indicate that Mound Laboratory operations have negligible effect on the environment. An appendix gives data on sampling location and concentrations radionuclides. (Houser-ORNL) ntrations of vari-W73-02709

RADIOACTIVITY OF WATERS PART OF ATLANTIC NORTHEASTERN URSR, Kiev. Morskyi

Akademiya Nauk U Hidrofizychnyf Instytut.

Hidrotzychnyt Instytut.

J. P. Baksheeva, A. D. Zemlyanoi, V. N.
Markelov, and B. A. Nelepo.
Available from NTIS, Springfield, Va., as JPRS55743; \$3.00 in paper copy, \$0.95 in microfiche.
Okeanologiya, Vol 11, No 6, p 1041-1048, NovDec. 1971. 4 fig, 1 tab, 22 ref.

Descriptors: *Surveys, *Environment, *Atlantic Ocean, *Assay, *Strontium, Measurement, Water pollution, Water pollution sources, Ion transport, Path of pollutants, Fallout, Nuclear explosions, Air pollution, Waste water disposal, Nuclear

Artificial radioactivity studies were carried out in the northeastern Atlantic Ocean in 1965-1966. Strontium-90 concentrations at the end of 1965 and the beginning of 1966 were higher than the average values for the whole ocean and amounted to about 50 disintegrations/minute 100 liters in the surface water layer. The most intensive transport of radioactive products from the Irish Sea was observed north and north-eastward along the Hebrides and Orkney Islands. Along with nuclear fragments resulting from nuclear weapon tests, in-dustrial atomic wastes discharged to the ocean are a potent source of radioactive pollution of some areas of the world's oceans. (Houser-ORNL) W73-02710

WEST VALLEY REPROCESSING PLANT. EN-VIRONMENTAL REPORT NO. 11, 2ND HALF

1971, Nuclear Fuel Services, Inc., West Valley, N.Y.
T. K. Wenstrand, and D. P. Wilcox.
Available from the National Technical Informa-

Avanuore trom the National Technical Informa-tion Service, Springfield, Va., as DOCKET-50201-112; \$3.00 in paper copy, \$0.95 in microfiche. Re-port No. DOCKET-50201-112, Feb. 29, 1972. 30 p, 1 fig. 17 tab.

Descriptors: "Monitoring, "Environment, *Background radiation, "Surveys, "Radiation, Measurement, Sampling, Fallout, Nuclear explosions, Civil defense, Nuclear wastes, Analytical techniques, Assay, Milk, Water, Fish, Deer, Food

The Nuclear Fuel Services (NFS) environs mental monitoring program provides a measure of the current environmental background surrounding the reprocessing plant. Samples collected at points where concentrations of effluents in the environment are expected to be the greatest are com-pared, where possible, with samples collected at points unaffected by plant operations. The latter samples provide background measurements as a basis for distinguishing radioactivity introduced into the environment by the operation of the plant from that due to other sources such as atmospheric fallout from nuclear detonations and natural causes. During the last half of 1971, over 2000 separate analyses of air, water, milk, fish, deer, and silt were performed. These analyses indicated the concentrations of radioactivity in the environment are far less than the applicable limits of the U.S. Atomic Energy Commission and the Federal Radiation Council. (Houser-ORNL) W73-02712

TRITIUM IN INVESTIGATION OF SURFACE HYDROLOGY. EXPERIMENTAL DETERMINA-TION OF COEFFICIENT OF RUNOFF.

Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research. E. Crouzet, P. Hubert, P. Olive, E. Siwertz, and A.

Marce. Available from NTIS, Springfield, Va., as CSIRO-TRANS-10757; \$3.00 in paper copy, \$0.95 in microfiche. Commonwealth Scientific and Industrial Research Organization-TRANS. 10757, 1970.

Descriptors: *Tritium, *Radioisotopes, *Measure-Descriptors: "Iritum, "Radioisotopes, "Measure-ment, "Runoff, Rivers, River flow, Floods, Flood data, Hydrology, Base flow, Groundwater move-ment, Hydrologic budget, Hydrologic data, Systems analysis, Watersheds (Basins), Radioactive tracers, Rain. Identifiers: *Hydrologic balance.

Measurement of tritium contents in rain and river allow for the determination of actual participation of rainwater in river flow during a flood. When the duration of the flood is shorter than the transit time of the ground water, the tritium content after the flood becomes reestablished at that value be-fore the flood and it is then not necessary to meathe tritium in the subterranean waters. Where the duration of the floods does not exceed one week, this simplification is valid. In the region studied the mean transit time of the shallow ground water is of the order of a month. The increase in flow-rate of the subterranean waters noted during floods is not accompanied by a variation of their tritium content. Only a putting in load of these waters is involved and not a mixing of the infiltrating rain and the ground water. It is as if the sheet of infiltrating water drives the water of the previous rainy periods in front of itself. Thus, actual determination by this method of the proportion of the rain water removed directly by runoff during floods allows one to establish more satisfactorily the hydrological balance of catchments. (Houser-ORNL) W73-02713

UPTAKE OF RUIOG BY MARINE ORGANISMS IN AQUARIA AND IN THE NATURAL EN-VIRONMENT (OBSERVATIONS CONCER-NANT LES CONTAMINATIONS EXPERIMEN-TALES ET LES CONTAMINATIONS 'IN SITU'
D'ESPECES MARINES PAR LE RUI06,
Commissariat a l'Energie Atomique, La Hague

J. Ancellin, and P. Bovard. Revue Internationale d'Oceanographie Medicalie, Vol 21, p 85-92, 1971. 4 ref.

Descriptors: "Nuclear wastes, "Food chains, *Estuarine environment, "Marine algae, Inver-tebrates, Absorption, Water analysis, Bioindica-tors, Radioactivity techniques, Path of pollutants, Solubility, Suspended solids, On-site investiga-tions, Laboratory tests. Identifiers: "Ruthenium radioisotopes, Ruthenium

Studies are briefly reviewed about uptake of Ru106 by marine organisms from a bay receiving nuclear wastes. Concentration factors (ratio of the activity of the organism to that of an equal weigh of water) were: algae (100-1,000), sponges (1,000-10,000), ascidians (1,000). The sample volume needed for water analysis was 40-80 liters. Suitable bioindicators of Ru contamination were: coralline algae, other algae, sponges, or the more rare ascidians. In laboratory studies in which insoluble suspensions of Ru compounds present in nuclear wastes were circulated in aquaria, concentration factors in agreement with the above were found; however, when only dissolved compounds were present in the water, the values were about an order of magnitude lower. (Bopp-ORNL) W73-02717

ENVIRONMENTAL MONITORING IN THE VICINITY OF THE LOS ALAMOS SCIENTIFIC LABORATORY, JULY THROUGH DECEMBER

Los Alamos Scientific Lab., N. Mex.

Available from NTIS, Springfield, Va., as report No. LA-4970, \$3.00 in paper copy, \$0.95 in microfiche. Report No. LA-4970, July 1972. 46 p, 14 fig, 27 tab, 1 app.

Descriptors: "Monitoring, "Measurement, "Data collections, "Effluents, "Operations, "Radiation, Regulation, Administrative agencies, Air pollution, Water pollution, Soil contamination, Sediments, Radioisotopes, Tritium, Public health. Identifiers: Plutonium, Los Alamos (New Mex-

The environmental monitoring program in effect at the Los Alamos Scientific Laboratory of the University of California for the last half of calendar year 1971 is described. Results of programs designed to monitor radiation levels in the Labora-tory environs, including the atmosphere, local surface and ground waters, sediments and soils are presented. These measurements are used to make estimates of the dose commitments due to plutonium and tritium concentrations in air. (Houser-ORNL) W73-02719

TRITIUM AND ITS EFFECTS IN THE EN-VIRONMENT - A SELECTED LITERATURE

SURVEY.
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs. For primary bibliographic entry see Field 05C. W73-02720

Group 5B-Sources of Pollution

SYMPOSIUM ON RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS EN-VIRONMENT,

European Communities, Luxembourg. Commis-

J. G. P. M. Smeets, A. Berlin, and R. J. Amavis. Nuclear Safety, Vol 13, No 5, p 380-391, Sept.-Oct. 1972, 1 tab.

Descriptors: "Nuclear wastes, "Water pollution effects, "Food chains, "Public health, Conferences, Europe, Tritium, Radioisotopes, Absorption, Ultimate disposal, International Commissions, Water pollution control, Hazards, Basins, Path of pollutants, Forecasting.

The symposia papers are listed and characterized briefly. Some of the questions raised at a 2.5-hour panel discussion are presented: effects from tritipanel discussion are presented: effects from tritum produced by fast reactors, accounting for parameters which affect radionuclide uptake, the term 'limiting radiological capacity' includes no safety factors, the term 'critical population' does not account for multiple sources and effects from other pollutants, and extension of the Euratom treaty to nonradioactive pollutants. Answers to many of these questions require further work in 'radiological forecasting' for a hydrological basin, also an analysis of hazards in connection with both adjunctive waste disposal and environmental conradioactive waste disposal and environmental con-tamination by tritium and the noble-gas radionuclides. (See also W72-10946) (Bopp-ORNI.) W73-02722

DISTRIBUTION OF RADIOACTIVITY IN AND NEAR THE RAINIER RUBBLE CHIMNEY,

Teledyne Isotopes, Las Vegas, Nev. E. H. Essington, and E. J. Forslow. Available from NTIS, Springfield, Va., as NVO-1229-180; \$3.00 paper copy, \$0.95 microfiche. Re-port NVO-1229-180, September 1971. 81 p, 6 fig, 9 tab, 3 ref.

Descriptors: Underground, *Nuclear explosions, *Radioactivity effects, *Water pollution effects, Groundwater, Nevada, Radioisotopes, Leaching, *Path of pollutants, Nuclear wastes, Analytical techniques, Radiochemical analysis, Radioactivity techniques, Ion transport, Tritium, *Rocks.

To obtain information for subsequent studies of To obtain information for subsequent studies of radionuclide transport by groundwater, the rubble chimney from the Rainier test (1957) was analyzed for the fission products Cs137, Sr90, Rulfo, Cs144, and Sb125; and the activation products Cs134, Co60, Eu152-154, and Fe55. Rock types sampled through exploratory shafts included meltiglass (produced by condensation of vaporized rock), contact melt (produced by heat transfer), unaltered rock and mixtures. Sample descriptions. unaltered rock, and mixtures. Sample descriptions and analytical and radiochemical procedures are given, including analysis of rocks for tritium. (Bopp-ORNL) W73-02723

RUI66 DISTRIBUTION IN A REDUCED MODEL SIMULATING RIVER BANKS; SOME HYDRODYNAMIC AND KINETIC ASPECTS OF ITS ADSORPTION ON SEDIMENTS (REPARTITION DU RUI66 DANS UN MODELE REDUIT SIMULANT LES BERGES D'UNE RIVI ERE),

SIMULANT LES BERGES D'UNE RIVI ERES, Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires. B. Lachet, J. Gagnaire, and R. Plebin. Available from NTIS, Springfield, Va., as CEA-R-4304; \$3.00 in paper copy, \$0.95 in microfiche. Re-port CEA-R-4304, April 1972. 28 p, 10 fig, 9 tab, 37

Descriptors: *Environmental effects, *Nuclear wastes, *Rivers, *Radioactivity effects, Adsorption, Sediments, Banks, Seepage, Suspende solids, Europe, Path of pollutants, Radioecology, Willow trees, Soil contamination, Radioactivity, Soil water movement,

Soil-water-plant relationships, Waste assimilative capacity.
Identifiers: Ruthenium radioisotopes, *Isere

Environmental effects of nitratonitrosyl Ru106 in Environmental effects of nitratonitrosyl Ru106 in experiments with plants growing on the Isere River bank. After 168-239 days Ru106 was several times higher in the leaves than in the roots of willow and poplar trees growing on the river bank, but was much higher in the submerged parts than in the leaves of reeds growing in the water. After 239 days very little of the Ru106 in bottom sediments had penetrated more than 2 mm below the surface. Low rates of transfer of Ru106 into Isere River sediment were measured in laboratory experiments which simulated the rate of natural seepage in the river. Data were obtained in Ru106 absorption by suspended sediments and was correlated tion by suspended sediments and was correlated with contact time. (Bopp-ORNL) W73-02724

PROGRESS REPORT, BIOLOGY AND HEALTH PHYSICS DIVISION, ENVIRONMENTAL RESEARCH BRANCH, JANUARY 1972 TO

MARCH 31, 1972,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
For primary bibliographic entry see Field 05C.
W73-02725

RESULTS OF ENVIRONMENTAL RADIOAC-TIVITY MEASUREMENTS IN THE COMMUNITY COUNTRIES IN 1970: AIR-FALLOUT-WATER (MESSWERTE DER UMWELTRADIOAKTIVITAT IN DEN LANDERN DER
GEMEINSCHAFT IM JAHRE 1970: LUFT
NIEDERSCHLAGE-WASSER).

European Communities, Luxembourg. Commis-

Available from NTIS, Springfield, Va., as EUR-4767; \$3.00 paper copy, \$0.95 microfiche. Report EUR-4767 d,f,i,n, 1972. 76 p, 6 fig, 22 tab.

Descriptors: "Fallout, "Strontium radioisotopes, "Radioactivity, Water pollution, "Path of pollu-tants, Europe, Monitoring, On-site data collec-tions, Public health, Potable water, Surface waters, Sea water, Water analysis, Trace ele-ments, "Water pollution control, Nuclear wastes, Background radiation, Radioisotopes, Potassium radioisotopes.

Data are reported from sampling networks maintained by the member states of European Communities, and from Euratom's research center at Ispra, Italy. Monthly data for radioactivity in air and fallout are compared over 1962-1970. Generally monthly values for 1970 only are given for drinking, surface-, and sea-water. The maximum values (in picoCuries/liter) are: total beta radioactivity in drinking water reported by Belgium (89), France (about 10), Germany (25), Netherlands (6); In surface waters, Belgium (112), France (44), Germany (21), Netherlands (about 5), various lakes and rivers near Ispra (86). Maximum values for individual radionuclides are given in surface waters near Ispra (Cs137, 2.7; Sr90, 5.1) and for seawater sampled by France (Cs137, 2.7; Sr90, 0.25). Max-sampled by France (Cs137, 2.7; Sr90, 0.25). Maxmean appra (CS157, 29.7; Sr90, 5.1) and for seawater sampled by France (CS137, 2.7; Sr90, 0.25). Max-imum values of other parameters in surface waters near Ispra are - 9900 pico-Curies CS137/g K and 317 picoCuries Sr90/g Ca. (Bopp-ORNL) W73-02726

LONG TERM RELEASE OF RADIOACTIVITY

LONG TERM RELEASE OF RADIOACTIVITY FROM RAINIER MELT-GLASS, Teledyne Isotopes, Las Vegas, Nev. E. H. Essington. Available from NTIS, Springfield, Va., as NVO-1229-177; \$3.00 in paper copy, \$0.95 in microfiche. Report NVO-1229-17, October 1971. 12 p, 2 fig, 2 tab, 2 ref. AEC AT (29-2)-1229.

Descriptors: "Underground, "Nuclear explosions, "Radioactivity effects, "Water pollution effects, Groundwater, Nevada, Strontium radioisotopes, Leaching, Ion transport, "Path of pollutants, Nuclear wastes, Sorption. Identifiers: Cesium radioisotopes, Antimony

To determine the extent of leaching of radionuclides from the sites of underground nuclear tests, samples of rubble from the Rainier test (1957) were crushed and leached by simulated groundwater for periods up to 4 years. The major beta-emitting radionuclides solubilized (Sr90, groundwater for periods up to 4 years. The major beta-emitting radionuclides solubilized (Sr90, Cs137, and Sb125) were present in the leaching water in amounts less than the maximum permissible concentration guides. Solubilization and sorption produced a steady-state concentration with Sr90 and Sb125, but Cs137 decreased after peaking at about 2-3 years. (Bopp-ORNL) W73-02727

ENVIRONMENTAL DYNAMICS OF MERCU-

RY, Michigan Univ., Ann Arbor. A. Jernelov, R. Hartung, P. B. Trost, and R. E.

In: Environmental Mercury Contamination, R. Hartung, and B. D. Dinman, Editors, Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1972, p 167-201. 7 fig, 9 tab, 20 ref.

Descriptors: *Mercury, *Food chains, *Solubility, *Humic acids, Fish, Absorption, Sediments, Or-ganic compounds, Bacteria, Chelation, Sulfides, Chlorides, Aquatic plants, Water pollution sources, Water analysis, Soils, Suspension.

Most surface waters contain about 0.1 ppb Hg, but this may be increased greatly by ultrafine particles in suspension. So far it has not been possible to differentiate clearly between inorganic and organic mercury in water samples from lates and rivers. Hg solubility is decreased by the presence of sulfides and is increased by chloride and by humic acid. The methylation rate in sediments is generally well correlated with the microbiological activity. In one study, untake by fish was found to activity. In one study, uptake by fish was found to depend on the presence of bacteria in the slime on depend on the presence of outers in the same on the fish. Uptake by terrestrial plants appears to be relatively unimportant in terrestrial food chains, but the role of aquatic plants requires further stu-dy (Bopp-ORNL) W73-02729

CONTEMPORARY SOURCES AND GEOCHEMISTRY OF TRITIUM IN THE GULF OF MEXICO AND ITS DISTRIBUTIVE

PROVINCE,
Texas A and M Univ., College Station.
G. P. Kincaid, Jr.

G.F. Kincand, Jr. Ph'd Dissertation, 1971. 243 p, 10 fig, 15 tab, 215 ref. 4 append. Available from University Microfilms, 300 No. Zeeb Road, Ann Arbor, Michigan 48106, Order No 72-5683.

Descriptors: "Tritium, "Hydrogen radioisotopes, "Gulf of Mexico, "Surface waters, "Atlantic Ocean, "Pacific Ocean, "Assay, Sampling, Analytical techniques, Water pollution, Water pollution sources, Distribution, Distribution patterns.

Sea water from the Yucatan Strait is the major source of tritium for the western Gulf. Sea water first carries the H3 to the Yucatan Strait, and then first carries the H3 to the Yucatan Strait, and then to the western Gulf. The physical properties of the water mass that extends from the surface of the depth of the Subtropical Underwater, and the H3 content, are modified by mixing processes as the water moves westward. The integrated H3 content of the water columns, to a depth of 150 m, is higher in the western Gulf than in the Yucatan Strait. This excess is due to the input of H3 from runoff and rainfall. A 2-box model was developed for the mixing and exchange of water masses in the upper layers of the Gulf of Mexico. This box model was the residence of the west mated mini this formula tions, was 3 W73-02730

INSOLUBL TION OF NITROSYL SOLUBLES POLYMER PLEXES DE DE MER), (France). P. Guegueni Comptes Re Feb. 7, 1972

Descriptors: Estuarine tion, Wate techniques, exchange, Polyelectrol tive capacity ties. Identifiers: '

Significant tion of the nitrato compresent in co 09184). Thre mixing with exchange te tionic resin eluted with were disting first-eluted standing in fractions we of a plastic than the firs W73-02731

ON ENVIRO D.C. Office Available ORP/SID

PROCEEDI

p, 55 fig, 15 Descriptors: *Monitoring lution, Wa Aquatic life pollution so

microfiche

tection from discuss pote nuclear pow the conferent identify and liquid and g ing nuclear p specify pat materials re may reach assists in de be contribut nuclear pow the confere their deliver W73-02737) W73-02732

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Sources of Pollution-Group 5B

model was used to derive a formula from which the residence time of the water in the upper 150 m of the western Gulf can be calculated. The esti-mated minimum residence time calculated from this formula, through a short series of approxima-tions, was 3.5 to 6 years. (Houser-ORNL) W73-02730

INSOLUBLE SPECIES AND POLYMERIZA-TION OF NITRATO COMPLEXES OF NITROSYLRUTHENIUM IN SEA WATER (NOUVELLES ETUDES SUR LES FORMES IN-SOLUBLES ET SUR LES PHENOMENES DE POLYMERISATION DES NITRATOCOM-PLEXES DU NITROSYLRUT HENIUM EN EAU

DE MER),
Commissariat a l'Energie Atomique, La Hague
(France).

P. Guegueniat. Comptes Rendus, Series D, Vol 274, p 822-825, Feb. 7, 1972.

Descriptors: *Nuclear wastes, *Path of pollutants, Bescriptors: Nuclear wastes, Frain of ponutants, **Estuarine environment, **Sedimentation, Absorp-tion, Water pollution effects, Radioactivity techniques, Analytical techniques, Cation exchange, Ion exchange, Cation adsorption, Polyelectrolytes, Waste dilution, Waste assimila-tive capacity, Effluents, Physicochemical properidentifiers: *Ruthenium radioisotopes.

Significant properties with respect to contamination of the marine environment were studied for nitrato complexes of nitrosylruthenium which are present in certain nuclear wastes (see also W71-09184). Three insoluble species which formed on mixing with sea water were characterized by ion exchange techniques. (They were sorbed on a cationic resin, Dowex 50-X8, 100-200 mesh; and eluted with nitric acid solution.) Three fractions were distinguished by their elution peaks. The first-eluted fraction transformed to the second on standing in acid solution. The second and third fractions were adsorbed more readily on the walls of a plastic container and had higher settling rates than the first. (Bopp-ORNL) W73-02731

PROCEEDINGS OF SOUTHERN CONFERENCE ON ENVIRONMENTAL RADIATION PROTEC-TION FROM NUCLEAR POWER PLANTS, APRIL 21-22, 1971. Environmental Protection Agency, Washington, D.C. Office of Radiation Programs

Available from NTIS, Springfield, Va., as ORP/SID 72-4; \$3.00 paper copy, \$0.95 microfiche. Report No. ORP/SID 72-4, 1972. 236 p, 55 fig, 15 tab, append.

Descriptors: *Nuclear powerplants, *Effluents, *Monitoring, *Population, *Public health, Air pollution, Water pollution, Soil contamination, Aquatic life, Radioactive waste disposal, Water pollution sources, Path of pollutants, Food chains.

The Southern Conference on Environmental Protection from Nuclear Power Plants was convened in St. Petersburg, Florida, on April 21-22, 1971, to discuss potential health hazards associated with nuclear power plants. Specifically, the purpose of the conference was to present techniques used to identify and monitor radionuclides contained in liquid and gaseous effluents produced by operating nuclear power plants. A second purpose was to specify pathways through which radioactive materials released by the nuclear power industry may reach the population. Such information assists in determining the radiation dose that may assass in determining the radiation dose that may be contributed to the national population by the nuclear power industry. The papers presented at the conference and the deliberations following their delivery are included. (See W73-02733 thru W73-02737) (Houser-ORNL) EVALUATION OF ENVIRONMENTAL FAC-TORS AFFECTING POPULATION EXPOSURE,

wash. J. F. Honstead, and T. H. Essig. In: Proceedings of Southern Conference on En-vironmental Radiation Protection from Nuclear Power Plants, April 21-22, 1971, St. Petersburg, Florida, 1972, p 29-57. 24 fig.

Descriptors: "Nuclear powerplants, "Effluents, Environment, "Environmental effects, "Popula-tion, Public health, Aquatic life, Food chains, "Path of pollutants, Krypton radioisotopes, Triti-um, Phosphorus, Zinc, Assay, Instrumentation. Identifiers: Whole body counter.

Discusses the environmental conditions, measure-ment methods, yardstick of evaluations, concenment metatous, yarustuca or evatuations, concentration factors, critical nuclides and their pathways to man. The exposure limits to the population under various conditions and by various radionuclides in air, water, and soil are reported. (See also W73-02732) (Houser-ORNL)

WASTE MANAGEMENT, Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div.

Generation Liv.
R. M. Hogg.
In: Proceedings of Southern Conference on Environmental Radiation Protection from Nuclear
Power Plants, April 21-22, 1971, St. Petersburg,
Florida, 1972, p 66-86, 7 fig, 2 tab.

Descriptors: *Nuclear powerplants, *Radioactive Descriptors: "Nuclear powerpiants, "Kadioacuve waste disposal, "Effluents, Discharge (Water), Discharge measurement, Assay, Monitoring, Water pollution, Air pollution, Water pollution sources, Flow rates, Waste dilution, Krypton, Tritium, Boron, Radioisotopes, Transportation, Regulation, Administrative agencies. Identifiers: "Waste transportation, Atomic Energy Commission."

Waste management in a light-water reactor and new equipment designed to further reduce the already low waste discharge from a nuclear steam system are discussed. (See also W73-02732) (Houser-ORNL)

THE TERRESTRIAL RADIOLOGICAL MONI-TORING PROGRAMS AT DUKE POWER COM-PANY'S OCONEE AND MCGUIRE NUCLEAR STATIONS.

Duke Power Co., Charlotte, N.C.

L. Lewis. L. Lewis.
In: Proceedings of Southern Conference on Environmental Radiation Protection from Nuclear Power Plants, April 21-22, 1971, St. Petersburg, Florida, 1972, p 131-160.2 fig., 5 tab.

Descriptors: *Nuclear powerplants, *Effluents, *Monitoring, *Radioactivity, *Path of pollutants, Population, Assay, Public Health, Regulation, Ad-

ministrative agencies.
Identifiers: Maximum permissible concentration,
Atomic Energy Commission.

An environmental monitoring program at a nuclear power station is an organized effort to sample and measure radioactivity in the vicinity of the station. This program is conducted to determine the contributions to the existing environmental radiation and radioactivity levels that result from station operations. It is also performed to evaluate the significance of this contribution, particularly, as it affects the health and safety of the public (radiation dose received by man). Monitoring programs are usually divided into preoperational and operational levels may provide a baseline to which operational levels can be compared. The Oconee and McGuire Nuclear Stations will use the latest available technology and will operate in com-

pliance with regulations requiring reactor opera-tors to reduce waste to as low a level as practica-ble. Radioactivity in the environment should, therefore, be several orders of magnitude below permissible concentrations and should cor-respondingly result in doses that are several orders of magnitude below permissible population limits. (See also W73-02732) (Houser-ORNL)

AQUATIC RADIOLOGICAL MONITORING BROWNS FERRY NUCLEAR PLANT, Tennessee Valley Authority, Muscle Shoals, Ala. Div. of Environmental Research and Develop-

G. F. Stone. In: Proceedings of Southern Conference on En-vironmental Radiation Protection from Nuclear Power Plants, April 21-22, 1971, St. Petersburg, Florida, 1972, p 161-176. 9 fig, 2 tab.

Descriptors: "Nuclear powerplants, "Effluents, "Monitoring, "Assay, "Radioactive waste disposal, Aquatic life, Absorption, Public health, Population, Path of pollutants, Regulation, Water pollution, Water pollution sources. Identifiers: Tennessee Valley Authority.

Preoperational environmental monitoring began at the Browns Ferry Nuclear Plant site in the spring of 1968, some two years before the first unit was scheduled to go into operation. The program has the objective of establishing a baseline of data on the distribution of natural and mammade radioactivity in the environment pear the plant site, so that when the plant becomes operational, it will then be possible to determine what contribution, if any, the plant is making to the environment. Discussed are the general features of the plant and Discussed are the general restures of the plant and its site, liquid waste processing and handling systems, and the reservoir monitoring system including sampling and analysis. Radiological monitoring also includes water, fish, plankton, sediment, and bottom fauna. A summary statement concerning the ecology of the area is given. (See also W73-02732) (Houser-ORNL)

AN ECOLOGICAL APPROACH TO MARINE RADIOLOGICAL MONITORING AT THE FLORIDA POWER CORPORATION CRYSTAL

FLORIDA POWER CORPORATION CRYSTAL RIVER NUCLEAR PLANT, Florida Univ., Gainesville. Dept. of Zoology. W. E. S. Carr, R. W. Englehart, and J. F. Gamble. In: Proceedings of Southern Conference on En-vironmental Radiation Protection from Nuclear Power Plants, April 21-22, 1971, St. Petersburg, Florida, 1972, p 177-193. 7 fig.

Descriptors: "Nuclear powerplants, "Effluents, "Monitoring, Aquatic life, "Marine animals, "Marine algae, Ecology, Ecosystems, Assay, Data collections, Aquatic habitats, Marshes, "Path of pollutants, Food chains, Public health, Sampling.

Marine aspects are discussed of a larger monitoring project which also includes fresh-water sampling, terrestrial sampling, and air sampling. This study was begun in August 1970. The objectives of the marine radiological monitoring program are as follows: (1) to gather baseline information on the preoperational levels of radionuclides existing in the marine environment; (2) to assess the major food chains which could be involved in directive radionuclides; into organisms consumed directing radionuclides into organisms consumed by man; (3) to provide a monitoring program which can be continued after commencement of plant operation in order to measure any possible effect operation in order to measure any possible effect of the power plant on the marine environment in terms of increased levels of radionuclides in organisms; (4) provide estimates of the future levels of critical radionuclides which are likely to appear in marine organisms consumed by man as a consequence of wastes discharged by the nuclear plant. (See also W73-02732) (Houser-ORNL) W73-02737

Group 5B-Sources of Pollution

APPLICATION OF CF252 TO THE DETECTION OF HEAVY METALS FOR POLLUTION CON-

TROL, Gulf Radiation Technology, San Diego, Calif. For primary bibliographic entry see Field 05A. W73-02738

ENVIRONMENTAL SAMPLING FOR RIVER SEDIMENTS AROUND A NUCLEAR POWER STATION.

New York Univ., N.Y. Inst. of Environmental

Medicine.
L. M. Hairr, and M. E. Wrenn.
Transactions available from American Nuclear
Society, Inc., 244 E. Ogden, Hinsdale, Ill. 60521.
S25.00/copy. In: Transactions of the American
Nuclear Society, 1972 Annual Meeting, June 1822, 1972, Las Vegas, Nevada, Vol 15, No 1, p 8283, 1972. 2 fig.

Descriptors: *Nuclear powerplants, *Effluents, *Monitoring, *Hudson River, Measurement, *Radioactivity, *Sediments, Biota, Aquatic life, Assay, Sampling, Model studies, Path of pollu-

Identifiers: *Dosimetry Dose calculation

Many environmental radiation surveillance programs around nuclear power stations depend on quarterly collection of grab sediment samples. The objectives of sediment sampling programs are probably to assess the buildup of activity in sediments originating from a plant with time, to pro-vide a measure of the concentration of radionuclides in sediments for dose calculations and to aid in the prediction of accumulation which might occur in biota from sediments. Sediment samples can be collected with dredges or by taking core samples. Accordingly, a field study was designed to compare the two methods of sampling and to evaluate the utility of the data obtained. Both dredge and core sampling were conducted in Hudson River sediments at five sites near the Indian Point nuclear power station. Samples were col-lected with an Emory dredge and by coring techniques concurrently at each site. (Houser-ORNL) W73-02740

ENVIRONMENTAL RADIOACTIVITY MEA-SUREMENT EXPERIENCE NEAR A FUELS REPROCESSING PLANT, New York State Dept. of Environmental Conser-

vation, Albany.

K. D. Anderson.

R. D. Anderson.

Transactions available from American Nuclear Society, Inc., 244 E. Ogden, Hinsdale, Ill., 60521. \$25.00 paper copy. In: Transactions of the American Nuclear Society, 1972 Annual Meeting, June 18-22, 1972, Las Vegas, Nevada, Vol 15, No 1, p 544-545, 1972. 4 ref.

Descriptors: *Nuclear powerplants, *Effluents, *Water pollution, *Air pollution, Water pollution sources, Sampling, Air, Water, Milk, Fish, Food chains, Public health, Administrative agencies, *New York, *Path of pollutants.

Extensive measurements of radioactive materials have been made in the environs of the Nuclear Fuels Services Reprocessing Plant as part of New York State's Environmental Radiation Surveil-lance program. Background measurements of gamma dose rates and radioactivity concentrations in air, milk, water, and fish were started two years prior to plant startup. Radioactivity concentrations and gamma dose rates were typical of radioactivity concentrations found in other parts of the State. Within 5 months of the initial processing of irwithin 5 months of the initial processing of irradiated fuel, concentrations of several radioisotopes began to appear in samples of water, silt, fish, and sediment. Future, and presently unknown doses due to 1129, Kr85, and H3 may be significant. (Houser-ORNL) W73-02741

ENVIRONMENTAL RADIATION DOSIMETRY NEAR LARGE NUCLEAR POWER STATIONS, New York Operations Office (AEC), N.Y. W. M. Lowder.

Transactions available from American Nuclear Society, Inc., 244 E. Ogden, Hinsdale, Ill., 60521. \$25.00/copy. In: Transactions of the American Nuclear Society, 1972 Annual Meeting, June 18-22, 1972, Las Vegas, Nevada, Vol 15, No 1, p 545.

Descriptors: "Nuclear powerplants, "Effluents, "Gases, "Radioisotopes, "Monitoring, Radioactivity, Meteorology, Instrumentation, Measurement, Assay, Model studies, Environment, Path of pollutants.

Identifiers: *Dose predictions, *Terrestral pollu-

The environmental radiation field near large nuclear power stations is both complex in composition and very low in intensity. The quantitative analysis of this field into those components directly attributable to routine operation of such facilities requires moderately sophisticated instrumentation and methods of data interpretation. At any given field location, the exposure rate from the gaseous effluent of a boiling water reactor (BWR) is a sensitive function of plume geometry, which in turn depends critically on locally variable meteorological conditions. A technique suitable for the direct and unambiguous quantitative assessment of plume exposure employs the monitor-ing ionization chamber. This technique depends on the fact that the time variation of plume exposure rate at any location is much more rapid than varia-tions in normal background. Experiments are now in progress at two nuclear power stations to: (a) obtain field exposure data at various on-site and off-site locations concurrently with appropriate meteorological and stack release data to determine the adequacy of various computational models of environmental dose prediction, and (b) correlate TLD (LiF and CaF2:Mn) results at many field lo-cations with monitoring chamber data at a few site (Money OPA). sites. (Houser-ORNL) W73-02742

TROUBLED WATERS, LAKE ERIE 1971, Social Technology Systems, Inc., Newton, Mass.

Available from NTIS, Springfield, Va., as PB-201 449; \$3.00 paper copy, \$0.95 microfiche. Report, 1971. 129 p, 2 tab, 2 append.

Descriptors: "Water pollution, "Water pollution sources, "Lake Erie, "Water pollution abatement, "Water pollution control, Thermal pollution, Tox-ins, Pesticides, Ecosystems, Mercury, Pesticide kinetics, Hydrology, Hydrologic aspects, Trans-missivity, Flow.

The increasingly urgent problems of pollution and pollution abatement that beset Lake Erie are discussed. A broad overview of the many ramifications of the subject is provided. The first of two sections is based on a series of conversations with experts in the various fields. The second section is nposed of topical abstracts and bibliographies of the subject which briefly recapitulates the state of the art in each field as it appears in the literature. (Houser-ORNL) W73-02743

ANNUAL REPORT OF THE EASTERN EN-VIRONMENTAL RADIATION LABORATORY, JANUARY-DECEMBER 1970. Eastern Environmental Radiation Lab., Mont-

Available from NTIS, Springfield, Va., as EERL-71-4; \$3.00 paper copy, \$0.95 microfiche. Report No EERL-71-4, Oct. 1971. 71 p, 22 fig, 5 tab, 17

Descriptors: *Monitoring, *Environment, *Air en-Descriptors: *Monitoring, *Environment, *Air environment, *Aquatic environment, *Soil contamination, *Sampling, *Analytical techniques,
Environmental effects, Water pollution, Water
pollution sources, Public health, Toxicity, Nuclear
physics, Radioactivity effects, Tritium, Radium,
Scientific personnel.
Identifiers: Dosimetry, Radiation safety, Radia-

The Eastern Environmental Radiation Laboratory The Eastern Environmental Radiation Laboratory (EERL) endeavors include the department of analytical and radiochemical methodology, and of nuclear facility surveillance technology. The activities of EERL for the 1970 calendar year are described. It is intended that this report provide the reader an understanding of the various Laboratory programs and an informative discussion of the projects conducted by the Laboratory during the previous year (Houser-ORNI). the previous year. (Houser-ORNL) W73-02744

RADIOACTIVE AND STABLE NUCLIDES IN THE COLUMBIA RIVER AND ADJACENT NORTHEAST PACIFIC OCEAN, Oregon State Univ., Corvallis. Dept. of Oceanog-

Available from NTIS, Springfield, Va., as RLO-1750-60; \$3.00 paper copy, \$0.95 microfiche. Re-port No RLO-1750-60, 1969. 68 p, 12 fig, 17 tab.

Descriptors: "Nuclear powerplants, "Effluents, "Columbia River, "Radioactive waste disposal, "Water pollution, Water pollution sources, Ecology, Ecosystems, Public health, "Pacific Ocean, Radioisotopes, Estuaries, Fallout, Mixing, Measurement. Identifiers: Snake River, Willamette River.

An integration is presented of previous studies of the Columbia River concerned with the environ-mental condition, radiation biology, geological surveys, public health, and radioecology. These studies were initiated to investigate the biogeochemical processes in the Columbia River resulting from the Hanford operations. (Houser-

ORNI.) W73-02745

ECOLOGICAL TECHNIQUES UTILIZING RADIONUCLIDES AND IONIZING RADIA-TION. A SELECTED BIBLIOGRAPHY, Washington State Univ., Pullman. Dept. of Zoolo-

Available from NTIS, Springfield, Va., as RLO-2213-1 (Suppl. 1); \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-2213-1 (Suppl. 1), Sept. 1972. 129 p, 1434 ref. AEC AT (45-1)-2221.

Descriptors: *Radioecology, *Radioisotopes, *Bibliographies, *Radioactivity techniques, Path of pollutants, Absorption, Neutron activation analysis, Analytical techniques, Nuclear wastes, Fallout, Aquatic life, Pollutant identification.

References are listed alphabetically according to the first author. Nuclear Science Abstracts was searched through 1970; and references were selected also from the bibliographies of Klement and Schultz (1970, 1971), Edmundson, Schultz and Klement (1969), and M. Bingelli (Radioisotopes and Ionizing Radiations in Entomology, Vol. 4 (1966-1967)). (Bopp-ORNL) W73-02746

URANIUM CONCENTRATION IN RECENT OCEAN SEDIMENTS IN ZONES OF RISING Akademiya Nauk SSSR, Moscow. Institut Oke-

G. N. Baturin, A. V. Kochenov, and Y. M. Senin. Geochemistry International, Vol 8, No 2, p 281-286, 1971. 1 fig, 2 tab, 27 ref.

Descriptors: *Bioassay, *Chemical Phosphorus, matter, Wild pollution, W

Recent sedin uranium con deepwater of of 10 ppm. T in these sedi cases the U is water, as is The U depos organic matte enters the se are biologica of mass deatl W73-02748

COLUMBIA NORTHEAS DIES. PROC 1972. Washington raphy.

Available fro 2225-T-26-5; microfiche. I 78 p. 3 fig. 41

Descriptors: discharge, productivity, Zooplankton environment, ton, Tidal wa radioisotopes Eutrophication Ecology, R Suspended lo

The sediment was highest a was estimate oxygen cons development planned althe thermal equi limitation. Pi was studied chlorophyli, tions, 15-199 released as tagging metho surements, a production. C tion. Study of during Sept.-(See also W73 W73-02750

COLUMBIA NORTHEAST GEOLOGICA SEPT. 1971 T Washington raphy.

Available fro 2225-T24-6; microfiche. R p, 20 fig, 4 tab

Descriptors: vironment, Sediment disc Washington, models, Comp Bed load, See analysis, An techniques, T

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution-Group 5B

Descriptors: *Oceans, *Uranium radioisotopes, *Bioassay, *Assay, *Analytical techniques, *Chemical analysis, Continental shelf, Phosphorus, Biological communities, Organic matter, Wildlife, Fjords, Ocean currents, Water pollution, Water pollution sources.

Recent sediments around continental coasts have Recent sediments around continental coasts have uranium concentrations several times those in deepwater oceanic sediments and are of the order of 10 ppm. The biogenic and diagenetic phosphates in these sediments have 10 - 100 ppm U. In both cases the U is accumulated by extraction from seawater, as is clear from the isotopic composition. The U deposition is related to the accumulation of organic matter and phosphorus as well as to USE. organic matter and phosphorus, as well as to H2S in the bottom water. Much organic matter and P enters the sediments of shelf zones because these are biologically very productive and have episodes of mass death of fauna. (Houser-ORNL) W73-02748

COLUMBIA RIVER EFFECTS IN THE NORTHEAST PACIFIC: BIOLOGICAL STU-DIES. PROGRESS REPORT, JULY 1971-JUNE

Washington Univ., Seattle, Dept. of Oceanog-

Available from NTIS, Springfield, Va., as RLO-2225-T-26-5; \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-2225-T-26-5, June 1972. 78 p., 3 fig. 41 ref., 3 append.

Descriptors: *Columbia River, *Sediment discharge, *Primary productivity, *Secondary productivity, Marine algae, Phytoplankton, Zooplankton, Herbivores, Food chains, Estuarine environment, Continental shelf, Oregon, Washingcuvinement, conditional stient, Oregon, washing-ton, Tidal waters, Cores, Sedimentology, Carbon radioisotopes, Path of pollutants, Diatoms, Eutrophication, Biochemical oxygen demand, Ecology, Radioecology, Sediment transport, Suspended load.

The sedimentation rate of utilizable organic matter was highest at the Columbia River mouth, decreas-ing with increasing distance from shore. The rate was estimated by shipboard measurements of the was estimated by shipboard measurements of the oxygen consumption by sediment cores. Further development of a microcalorimetric method is planned although the time (4 days) for reaching thermal equilibrium of the core metabolism is a limitation. Phytoplankton-derived organic matter was studied at the depth of the maximum in chlorophyll, and also at the surface. At both posichlorophyll, and also at the surface. At both posi-tions, 15-19% of the photoassimilated C was released as dissolved organic matter. A C14 tagging method is being developed for these mea-surements, and for estimation of secondary production. Organic, particulate C and N are the basis for another estimate of secondary produc-tion. Study of the diatom Chaeloceros armatum during Sept.-May blooms in the surf is described. (See also W73-02751) (Bopp-ORNL) W73-02750

COLUMBIA RIVER EFFECTS IN THE NORTHEAST PACIFIC: CHEMICAL AND GEOLOGICAL STUDIES. PROGRESS REPORT, SEPT. 1971 TO MAY 1972.

Washington Univ., Seattle. Dept. of Oceanog-

Available from NTIS, Springfield, Va., as RLO-2225-T24-6; \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-2225-T24-6, May 1972. 49 p, 20 fig, 4 tab, 44 ref. AEC AT (45-1)-2225-T24.

Descriptors: *Columbia River, *Estuarine en-vironment, *Trace elements, *Sedimentation, Sediment discharge, Mercury, Continental shelf, Washington, Oregon, Runoff, Storms, Computer washington, Oregon, kutori, Storms, Computer models, Computer programs, Beds (Stratigraphic), Bed load, Sediments, Sorption, Leaching, Water analysis, Analytical techniques, Radioactivity techniques, Tracers, Tagging, Path of pollutants.

Identifiers: Arsenic, Antimony.

Analysis of Columbia River water in the vicinity of Longview, Washington, showed much less Hg (about 0.01 ppb) than reported by others. Analysis of Washington continental shelf sediments gave: of Washington continental shelf sediments gave: Hg, 7-93 ppb; As 3.5-12 ppm; Sb, 0.2-1.1 ppm. The Hg content of various sediments (downstream from Portland, Oregon, 7-17 ppb; Columbia River suspended material, 2-72 ppm) generally increased with decreasing particle size. Sorption-desorption by Columbia River suspended material was stu-died using Columbia River water spiked with inor-ganic and organic Hg203 (M. H. Bothner and R. Carpenter, Paper IAEA/SM-158/5, July 1972). An annual deposit of 8.2 million tons of sediment near the Columbia River mouth was estimated from insitu filtration and bottom current measurements. higher than was estimated from secular changes. A computer model is being programmed for the rates of transport of suspended and bed-sediment; in-cluding effects of altering the quality and quantity of discharge from the river, and the timing between storms and the peaking of runoff. (See also W73-02750) (Bopp-ORNL)

ORIGIN OF MANGANESE NODULES OF THE PACIFIC OCEAN FROM RADIOISOTOPE

Akademiya Nauk SSSR, Moscow. Geologicheskii Institut

V. V. Cherdyntsev, N. B. Kadyrov, and N. V.

Novichkova. Geochemistry International, Vol 8, No 2, p 211-225, 1971. 4 fig, 7 tab, 14 ref.

Descriptors: "Assay, "Igneous rocks, "Lava, "Pacific Ocean, "Radioisotopes, "Cores, Sampling, "Sediments, "Uranium radioisotopes, "Manganese, Water pollution, Water pollution sources, Surface waters. Identifiers: *Thorium.

Contents of the uranium and thorium isotopes U234, U238, Th232, Io (Th230), Rd Th (Th228), Pa231, and Pu239 have been determined in more than one hundred manganese nodules from the Pacific Ocean, in their volcanogenic cores, and in the underlying deep sea sediments and pumice. The Th/U ratio varies greatly in the manganese nodules (from 0.28 to >47) and is usually correlated with Io/U238 and Pa/U235, but there is little variation in the Io/Th ratio. No genetic relation-ship is observed between the nodules and the underlying sediments and pumice. Uranium content volcanogenic cores of the nodules is tens of times higher than in the oceanic island basalts. This may be ascribed to the introduction of uranium during the formation of manganese nodules. (Houser-ORNL)

EVALUATION OF ION-EXCHANGE SURVEIL-LANCE SAMPLER FOR ANALYZING RADIOACTIVE LIQUID EFFLUENTS, Bureau of Radiological Health, Cincinnati, Ohio. Radiological Engineering Lab.
For primary bibliographic entry see Field 05A. W73-02753

TRACE-METAL ASSOCIATIONS IN SUB-A-RTIC AND ARCTIC MARINE ENVIRONMENTS PROGRESS REPORT, JUNE 1971-MAY 1972, Alaska Univ., Fairbanks. Inst. of Marine Science.

Available from NTIS, Springfield, Va., as RLO-2229-T1-18, \$3.00 paper copy, \$0.95 microfiche. Report RLO-2229-T1-18, May 1972. 136 p, 18 fig, 16 tab. 103 ref.

Descriptors: *Aquatic environment, *Estuarine environment, *Arctic Ocean, *Geochemistry, *F-jords, Sediments, Research and development, Analytical techniques, Sea water, *Trace ele-

ments, Chromatography, Solvent extractions, Absorption. Identifiers: *Sub-Arctic.

Current research projects are reported and details given, including geochemistry of subarctic fjords and the Arctic Ocean. Various analytical aspects of the marine research are given. These include analysis of trace metals in the seawater by gasliquid chromatography, solvent extraction of metals from seawater, and determination of silver in seawater by atomic absorption spectrometry. (Houser-ORNL)

RADIONUCLIDE CYCLING IN NATURAL POPULATIONS OF AMPHIBIANS. ANNUAL PROGRESS REPORT, JUNE 16, 1971 - JUNE 15,

Oregon State Univ., Corvallis. Dept. of General For primary bibliographic entry see Field 05C. W73-02755

OBSERVATIONS AND OTHER CHARAC-

TERISTICS OF THERMALS, Minnesota Univ., Minneapolis. For primary bibliographic entry see Field 08B. W73-02757

WAVE-INDUCED BOUNDARY LAYERS IN A STRATIFIED FLUID.

California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry see Field 08B.
W73-02761

A METHOD FOR CALCULATING THE SIZE OF COOLING TOWER PLUMES, Royal Netherlands Meteorological Inst., De Bilt. For primary bibliographic entry see Field 05G. W73-02763

BIOLOGICAL ASPECTS OF THERMAL POL-LUTION, IL SCIENTIFIC BASIS FOR WATER TEMPERATURE STANDARDS AT POWER

Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C. W73-02766

THERMAL EFFECTS OF THE SURRY NUCLEAR POWER PLANT ON THE JAMES RIVER, VIRGINIA; PART II: RESULTS OF MONITORING PHYSICAL PARAMETERS OF ENVIRONMENT PRIOR TO PLANT

Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 05C. W73-02767

DISCHARGE OF WASTE HEAT, Joint Labs. of the Electric Utilities in the Nether-lands, Arnhem. For primary bibliographic entry see Field 05C. W73-02770

THE MAJOR UNRESOLVED FOULING: FOULING: THE MAJOR UNRESOLVE PROBLEM IN HEAT TRANSFER, Heat Transfer Research, Inc., Alhambra, Calif. For primary bibliographic entry see Field 08B.

THERMAL STRATIFICATION AND THER-MOCLINE CONTROL IN STORAGE RESER-VOIRS, Metropolitan Water Board, London (England).

Group 5B-Sources of Pollution

Proceedings of the Society for Water Treatment and Examination, Vol 13, Part 4, p 275-297, 1964. 6 fig, 4 tab, 31 ref.

Descriptors: "Thermocline, "Destratification, "Reservoirs, Mixing, "Thermal stratification, Circulation, Biochemistry, Jets, Phytoplankton, Biology, Aquatic habitats, Zooplankton. Identifiers: "Eutrophic impoundments, Great

Some problems likely to be encountered by the waterworks industry when, in the near future, plans are made for the construction of new reserplans are made for the construction of new reservoirs to depths much greater than previously envisaged in lowland areas are described. Apart from the obvious improvements in reservoir management brought about by the use of jet-type inlets and off-shore outlets, there appears to be a need to consider means of inducing internal circulation in standing reserves so that thermal stagnation can be controlled. With does negativities with internal stagnation can be controlled. With deep reservoirs and waters rich in nutrients, water quality will depend on the physinutrients, water quality will depend on the physical state of the water mass. In particular, the density layering produced during periods of thermal stratification and also the partial, or complete, destruction of this condition by wind-induced turbulence cause many purification problems. Detailed studies of the physicochemical conditions are essential to a better understanding of phytoplankton and zooplankton production in storage reservoirs. (Oleszkiewicz-Vanderbilt) W73-02777

CONTROL OF THERMAL STRATIFICATION IN THAMES VALLEY RESERVOIRS, Metropolitan Water Board, London (England). J. E. Ridley, P. Cooley, and J. A. P. Steel. Proceedings of the Society for Water Treatment and Examination, Vol 15, Part 4, p 225-244, 1966. 9 fig. 2 tab. 19 ref.

Descriptors: *Reservoirs, *Thermal stratification, *Destratification, Water quality, Mixing, Circulation, Biochemistry, Jets, Phytoplankton, Biology, Aquatic habitats.

Identifiers: *Eutrophic impoundments, *Thames

Thermal stratification in eutrophic impoundments used for waterworks purposes causes problems of quality control. Trials at two storage reservoirs (15,000 to 20,000 acre-feet) are described and show that mixing of the water mass can be achieved at low cost; the methods used were jet-type inflow and sub-surface transference pumps. type inflow and sub-surface transference pumps. Improved biochemical quality to greater depths in the impoundment was achieved, but some reserva-tions are expressed concerning phytoplankton production and distribution resulting from artifi-cial circulation. (Oleszkiewicz-Vanderbilt)

A STUDY ON THE CHEMICAL BEHAVIOR OF ZINC IN CHESAPEAKE BAY WATER USING ANODIC STRIPPING VOLTAMMETRY, Johns Hopkins Univ., Baltimore, Md. Chesapeake Ray Inst. W. L. Bradford.

Chesapeake Bay Institute Technical Report 76 (Reference 72-7), June 1972. 103 p, 29 fig, 8 tab, 58 ref, append. AEC Contracts AT (30-1)-3497 and AT (11-1)-3292.

Descriptors: *Water chemistry, *Chemical analysis, *Chemical reactions, *Zinc, *Chesapeake Bay, Analytical techniques, Electrodes, Salinity, Organic matter, Sediments, Ion exchange, Chela-tion, Copper, Nickel, Cobalt, Water pollution

Anodic Stripping Voltammetry from a thin layer of mercury was used to analyze Chesapeake Bay water for zinc directly at concentrations between 0.5 and 20 parts per billion (ppb). In the upper Bay

just below the outfall of the Susquehanna River zinc is desorbed from sediments freshly deposited by the spring freshet. The desorption is caused by cation exchange with the higher salinity water which intrudes over the sediments when the freshet ceases. The sequestering of zinc by suspended organic matter was substantial in late summer when phytoplankton blooms had accumulated a concentration of organic matter exceptionally high compared with the rest of the year. Different rates of reaction between zinc and chelators were found at different times of the year. tors were found at different times of the year. Naturally occurring chelators seemed to have sta-bility constants for reaction with copper, nickel and cobalt which are higher than the stability con-stants for reaction with zinc. (Woodard-USGS)

GRAVITATIONAL AND DISPERSIVE MIXING IN AQUIFERS, Massachusetts Inst. of Tech., Cambridge. Dept. of

Civil Engineering.
For primary bibliographic entry see Field 02F.
W73-02791

CHEMICAL AND BACTERIOLOGICAL QUALITY OF WATER AT SELECTED SITES IN THE SAN ANTONIO AREA, TEXAS, AUGUST 1968-

ARIUNIU AREA, TEAAS, AUGUST 1998--APRIL 1972, Geological Survey, Austin, Tex. R. D. Reeves, J. Rawson, and J. F. Blakey. Edwards Underground Water District Report, Au-gust, 1972. 63 p, 6 fig, 2 tab, 11 ref.

Descriptors: "Water quaMunicipal wastes, lity,
"Chemical analysis, "Water pollution sources,
"Pollutant identification, "Texas, Urbanization,
Industrial wastes, Municipal wastes, Aquifers,
Agricultural chemicals, Pesticides, Coliforms,
Nitrates, Phosphates, Dissolved solids, Chlorides,
Sulfates, Water analysis.
Identifiers: "San Antonio (Tex), Edwards aquifer.

Urban development on or adjacent to the recharge zone of the Edwards aquifer is causing concern about the possible pollution of groundwater in the aquifer, which is the principal source of water supply for the San Antonio, Texas, area. Water from the Edwards aquifer is very hard and of the calcium bicarbonate type. The concentrations of dissolved solids in samples from wells and springs ranged from about 200 to 470 mg/liter. The chloride and sulfate concentrations ranged from 6.5 to 62 mg/liter and from 0.0 to 65 mg/liter, respectively. The nitrate contents ranged from 0.0 respectively. The nitrate contents ranged from 0.0 to 15 mg/liter and phosphate from 0.00 to 0.37 mg/liter. The chemical quality of water has not been degraded significantly by domestic, industri-al, or agricultural effluents. However, variations in the number of coliforms, the concentrations of nitrate and phosphate, and the presence of fecal coliforms and fecal streptococci in samples from some wells show that fecal pollution is reaching the aquifer. Trace amounts of several pesticides were detected in samples from two wells in the San Antonio area. Field investigations showed the source of pesticides in these wells to be surface drainage that entered the wellbores. (Woodard-USGS) W73-02808

THERMODYNAMIC ANALOGY OF MASS TRANSPORT PROCESSES IN POROUS MEDIA, Illinois Univ., Urbana. Dept. of Mining, Metallur-gy and Petroleum Engineering. For primary bibliographic entry see Field 02F. W73-02819

SOME ASPECTS OF HEAT AND MASS TRANSFER IN POROUS MEDIA, Technion - Israel Inst. of Tech., Haifa. For primary bibliographic entry see Field 02F. W73-02823

ON STABILIZATION OF FINGERS IN A SLIGHTLY CRACKED HETEROGENEOUS POROUS MEDIUM, Maharaja Sayajirao Univ. of Baroda (India). For primary bibliographic entry see Field 02G.

THE TENSOR CHARACTER OF THE DISPER-COEFFICIENT IN ANISOTROPIC SION COEFFICIENT IN ANISOTROPIC POROUS MEDIA,
Technische Hogeschool, Delft (Netherlands).
Dept. of Civil Engineering.
For primary bibliographic entry see Field 02G.
W73-02831

ON THE DERIVATION OF A CONVECTIVE-DISPERSION EQUATION BY SPATIAL AVERAGING. State Univ. of New York, Buffalo. Dept. of Engineering Science.
For primary bibliographic entry see Field 02F.

MODEL TESTS TO STUDY GROUNDWATER FLOWS USING RADIOISOTOPES AND DYE

TRACERS, Gesellschaft fuer Strahlenforschung m.b.H., Mu-nich (West Germany). Institut fuer Radiohydrometric. For primary bibliographic entry see Field 02F. W73-02838

SORPTION IN FLOW THROUGH POROUS MEDIA Utah Water Research Lab., Logan. For primary bibliographic entry see Field 02G. W73-02839

SOURCES OF NUTRIENTS IN CANADARAGO

LAKE, New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit. For primary bibliographic entry see Field 05C. W73-02859

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY, SUMMARY REPORT AND CONCLUSIONS. Army Engineer District, Baltimore, Md. For primary bibliographic entry see Field 05G. W73-02869

CODORUS CREEK WATER QUALITY IN-VESTIGATION REPORT,
Environmental Protection Agency, Philadelphia, Pa. Region III.

For primary bibliographic entry see Field 05G.

W73-02870

MANGANESE, ZINC AND COPPER CONTENT IN ORGANS AND TISSUES OF CARP UN-DERYEARLINGS, (IN RUSSIAN), E. E. Galicheva

Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 269-275. 1970. English

Identifiers: *Carp, *Copper, *Manganese, Organs, Tissues, Yearlings (Carp), *Zinc.

Data on the amount of Mn, Cu and Zn in the body of domestic carp underyearlings suggest theories on biological doses of these elements under conditions of a biogeochemical province.—Copyright 1972, Biological Abstracts, Inc. W73-02884

POLLUTIO OGALLAL MEXICO, Eastern No Biological S P. D. Bigber M.Sc Thesi OWRR A-0

Descriptors
*New Mexi Recharge, I E. coli Identifiers: Coliform co

Preliminary vicinity of presence of radius of th these bacter study has e parameters of to elucidate sources of t terial and techniques i nitrate, pH, were perform The sampling radii, extend town of Po sampled. Bo was found in pled and a established. between nitr the summer tamination v potential apprinted amounts, ni compounds i found that was converte Escherichia Throughout months, littl coliform den W73-02891

TURBULEN' SLOT JET STREAM, Rhode Islan Mechanical E A. J. Patton. Ph.D. Thesis. pend. OWRR

Descriptors: sion, Streams sources, Path Identifiers: B

An experimen dimensional, velocity profitained for un profiles were of jet injection to predict the heated jet. The 90 deg. injecti tion angle, ev early stages of W73-02895

THE VERTIC WATER AND Naval Postgra

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Sources of Pollution-Group 5B

POLLUTION STUDIES OF THE REGIONAL OGALLALA AQUIFER AT PORTALES, NEW MEXICO, Eastern New Mexico Univ., Portales. Dept. of

Eastern New MEXICO Univ., Portales. Dept. of Biological Sciences. P. D. Bigbee. M.Sc Thesis, 1972. 69 p, 12 fig, 17 ref, 1 append. OWRR A-034-NMEX (1).

Descriptors: *Coliforms, Water pollution sources, *New Mexico, *Nitrates, *Phosphates, Irrigation, Recharge, Rainfall, Hydrogen ion concentration,

Identifiers: *Ogallala Aquifer, *Portales (NMex), Coliform contamination, Soil columns.

Preliminary examination of the aquifer in the vicinity of Portales, New Mexico, indicated the presence of coliform bacteria within a two mile radius of the town of Portales. The presence of these bacterial organisms in the water table at Portales is indicative of recharge to the aquifer. This study has examined both chemical and bacterial parameters of the aquifer and extended the results to elucidate any possible seasonal variations and sources of the pollution in the ground water. Bacterial and chemical analyses were done using sources of the pollution in the ground water. Bacterial and chemical analyses were done using techniques in accordance with U.S. Public Health Service standards. Chemical analyses included nitrate, pH, and phosphate. Bacterial analyses were performed using membrane filter techniques. The sampling area consisted of a series of two mile radii, extending a distance of ten miles from the town of Portales. Twenty-two rural wells were sampled. Both bacterial and nitrate contamination was found in verying amounts invest walls seen. sampled. Both oacternal and mitrate contamination was found in varying amounts in most wells sampled and a correlation between the two was established. A relationship was found to exist between nitrate concentration and rainfall during the summer sampling interval. No phosphate contamination was found. Periods of high recharge potential appeared to parallel pH variation. An in vitro study was done to determine if, and in what amounts, nitrate was converted to nitrogenous compounds including nitrite in soil columns. It was compounds including nitrite in soil columns. It was found that approximately 47% available nitrate was converted to other nitrogenous compounds by Escherichia coli in the columns including nitrite. Throughout the year except for the summer months, little variation in nitrate concentration, coliform density, or pH was observed.

TURBULENT THERMAL DIFFUSION OF A SLOT JET FLOWING INTO A MOVING

Rhode Island Univ., Providence. Dept. of Mechanical Engineering and Applied Mechanics. A. J. Patton.

Ph.D. Thesis, 1972. 229 p, 76 fig, 1 tab, 35 ref, 4 append. OWRR B-028-RI (1), 14-31-0001-3329.

Descriptors: *Thermal pollution, *Jets, *Diffu-sion, Streams, Open channel flow, Water pollution sources, Path of pollutants, *Turbulent flow. Identifiers: Buoyant jets.

An experimental investigation of a turbulent, twodimensional, heated slot jet was conducted. Mean velocity profiles and turbulent intensities were obvelocity promes and unrounced intensities were ob-tained for unheated jets and mean temperature profiles were obtained for heated jets. Two angles of jet injection were used with a wide range of velocity ratios. An integral method was developed velocity ratios. An integral method was developed to predict the trajectory, spreading, velocity decay and temperature decay of a two-dimensional heated jet. The solution worked well for both the 90 deg. injection angle and 30 deg. upstream injection angle, even though the profiles vary from the assumed distributions for the 30 deg. case in the early stages of jet behavior.

W73-02895

THE VERTICAL MOVEMENT OF OIL IN SEA-WATER AND THE AGING OF OIL SLICKS, Naval Postgraduate School, Monterey, Calif.

For primary bibliographic entry see Field 05G. W73-02904

SPILL CHARACTERISTICS

STATISTICS, STATISTICS, Naval Postgraduate School, Monterey, Calif. Naval Postgraphic entry see Field 05G. For primary bibliographic entry see F W73-02906

REDUCTION OF OIL SPILLS DURING SHIP-BOARD FUEL MOVEMENT EVOLUTIONS, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02907

MATHEMATICAL MODELS FOR REGIONAL ECONOMIC AND WASTE LOAD PROJEC-

Environmental Protection Agency, New York. Data Systems Branch.

Data Systems Branch. E. T. Smith, and R. E. Braster. In: Institute of Environmental Sciences 1972 Proceedings, 18th Annual Technical Meeting, 'Environmental Progress in Science and Education, May 1-4, 1972, p 44-52. 8 fig. 7 ref.

Descriptors: *Wastes, *Water quality, *Waste treatment, Estuaries, Mathematical models, Simulation analysis, Projections, Cost-benefit analysis, Pollution abatement, Regional analysis.
Identifiers: *Waste load, *Delaware estuary.

Several mathematical models are developed in order to project waste loads on the Delaware Estuary for the period 1964-2010. These models suggest that the waste load will increase 50 percent by 1975 and 300 percent by 2010. Consequently, if waste removal had reached 85 percent in 1964, it waste removal had reached 85 percent in 1964, it would have to increase to 90 percent by 1975 and 96 percent by 2010 merely to keep water quality constant. Under the assumptions that (1) the benefits of pollution control are approximately proportional to the population affected, and (2) costs are proportional to total waste load, the potential benefits from pollution control increase from 1.2 to 1.8 faster than costs over the period from 1.2 to 1.3 taster than costs over the period studied. Costs will probably increase faster than waste load growth because of quality upgrading. However, this water quality improvement will, in turn, cause a nonproportionate increase in benefits from pollution control. Thus, while it will be rela-tively more difficult and expensive to maintain or increase water quality over time, the resulting benefits of such efforts should be relatively great. (Settle-Wisconsin) W73-02920

POLLUTION BY COLIFORM BACTERIA IN SEA WATER OF SWIMMING RESORTS: II (IN JAPANESE), Chiba Univ. (Japan). Chiba Sch. Pharm. Assoc. S. Ishii, D. Mizuno, S. Yamanaka, M. Hayashi, and N. Kanbayashi.

Vol 17, No 5, p 333-336. 1971. Illus. J Hyg Chem.

Map. English summary.
Identifiers: *Bacteria, *Coliform, Water pollution,
Sea water, *Sodium chloride, Water pollution

Thirty-three water samples were collected around the outflow of the Shiori River at Tateyama City and each sample was analyzed for the most proba-ble number (MPN) of coliform bacteria and for the be number (MPN) of comorm secters and for the concentration of NaCl. A significant correlation between the logarithm of the MPN value and the concentration of NaCl was ascertained by statistical analysis.—Copyright 1972, Biological Abstracts, Inc. W73-02928

RELATING KRAFT WASTE STREAM PROPER-TIES TO BIOCHEMICAL OXYGEN DEMAND, Chesapeake Corp. of Virginia, West Point. W. D. South.

Tappi J Tech Assoc Pulp Pap Ind. Vol 54, No 11, p 1833-1837. 1971. Illus. Identifiers: "Biochemical oxygen demand, Color, "Conductivity, Evaporation, Kraft liquor wastes, Measurement, Mill, Pulp wastes, Solids, Soluble solids, Stream, Wastes.

The waste stream properties investigated included color, total soluble solids, and conductivity. These studies showed that simple color measurements could predict 5-day biochemical O2 demand (BOD) levels in waste streams from pulp washing, liquor evaporation and paper mill operation. These studies also indicated that color measurements could be helpful in identifying controlling the could be helpful in identifying controlling the sources of organic material causing BOD in these waste streams.—Copyright 1972, Biological Ab-W73_02940

A SYSTEM FOR THE RAPID ANALYSIS OF ORGANIC PHOSPHORUS IN WATER SAM-PLES OR FRACTIONS FROM CHROMOATO-GRAPHIC COLUMNS.

Guelph Univ. (Ontario). Dept. of Land Resource Science

For primary bibliographic entry see Field 05A. W73-02968

ANTIBODIES AGAINST HUMAN ENTERIC BACTERIA IN BROWN BULLHEADS (ICTALU-RUS NEBULOSUS, LESEUER) FROM CON-TAMINATED WATERS. West Virginia Univ., Morgantown.

For primary bibliographic entry see Field 05C. W73-02975

WHAT WATER AND WASTE WATER PARAMETERS SHOULD WE MEASURE, Wapora, Inc., Rockville, Md. Water Quality Programs. For primary bibliographic entry see Field 05A. W73-02976

METHODS FOR THE CHARACTERIZATION OF SUSPENDED SEDIMENT AND SELECTED APPLICATIONS FOR THE ACQUIRED DATA,
Battelle-Pacific Northwest Labs.. Richland.

R. C. Routson, and R. E. Wildung. Report BNWL SA-4385 (1972), 23 p. 17 fig, 6 tab, 17 ref. AEC AT (4S-1) - 1830.

Descriptors: "Methodology, "Sediment transport,
"Suspended solids, "Analytical techniques,
"Model studies, Sediments, Sedimentology, Erosion, Centrifugation, Particle size, Mineralogy,
Water purification, Turbidity, Deposition (Sediments), "Columbia River, Chemical properties, Sorption, Runoff, Trace elements, Sedimentatio Erosion control, Construction, Polyelectrolytes. Identifiers: Sediment transport model, Soil ero-sion model, Chemical erosion treatment, Tube sedimentation.

Analytical methods required to develop predictive models of sediment and sorbed pollutant transport include isolation of suspended sediment from water, determination of quantity of suspended sediment, determination of particle size distributions and separation into particle size fractions, mineralogical analyses, and characterization of surface chemistry. Particle size analysis estimated sediment depth deposited behind McNary Dam on the Columbia River. Relative decay of two radionuclides with different half-lives can be used to date sediments. Chemical characterization made on samples included the cation exchange capacity, organic fraction characterization, inorcapacity, organic fraction characterization, in ogy, and sorption of some trace con game mneratogy, and sorption or some trace com-ponents. Two models are briefly discussed. A systematic study of chemicals capable of decreas-ing detachability of the soil should be made and those applied to either increase soils' ability to re-

Group 5B-Sources of Pollution

sist detachment or increase the infiltration rate of the soils to reduce erosion. Tube sedimentation appears promising to remove sediment runoff from construction sites. In conjunction with this, polyelectrolyte treatment of runoff prior to sedi-mentation might be desirable to effect removal of fine particulate matter which would otherwise pass through the sedimentation device. Use of polymers to enhance flocculation and sedimentation is quite common and in-stream silt removal by polyelectrolyte induced sedimentation has been demonstrated. (Jones-Wisconsin) W73-02977

ON THE PHYTOPLANKTON OF WATERS POLLUTED BY A SULPHITE CELLULOSE

Jyvaskyla Univ. (Finland). Dept. of Biology. For primar W73-02979 nary bibliographic entry see Field 05C.

WATER FOR TEXAS.

Texas A and M Univ., College Station. Water Resources Inst.

Proceedings of the 15th Annual Conference on Water for Texas, November 23-24, 1970, Texas A and M University, College Station: 1971. 170 p. OWRR A-999-TEX (4).

Descriptors: *Water resources development, Descriptors: "Water resources development, "Hydrology, "Water pollution sources, "Environ-mental effects, "Ecology, Rivers, Lakes, Estua-ries, Bays, Gulfs, Industrial wastes, Municipal wastes, Agricultural chemicals, Ecosystems, Water quality, Conferences, Texas.

Eleven papers were presented at the Fifteenth An-Eleven papers were presented at the Fitteenth An-nual Conference on Water for Texas held at the Water Resources Institute, Texas A and M University, on November 23-24, 1970. The Con-ference theme was 'Water Development and the Quality of the Environment.' Paper topics include: how can we live with environment; our dwindling lakes-man hastens the process; vegetation, runoff and sediment yield relationships; the impact of and sediment yield residonships; the impact of water development on ecology of river systems; the impact of water development on ecology of bays and estuaries; the impact of water develop-ment on ecology of the Gulf of Mexico; ecology and water quality criteria; system analysis in water and water quanty criterias; ystem analysis it water resource management; summary and synthesis; objectives in water resources development; and water development and economic growth. (See W73-03067 thru W73-03070) (Woodard-USGS) W73-03066

VEGETATION, RUNOFF, AND SEDIMENT YIELD RELATIONSHIPS,

Geological Survey, Denver, Colo.

F. A. Branson. In: Water for Texas; Proceedings of the 15th Annual Conference on Water for Texas, November 23-24, 1970, Texas A and M University, College Station, p 28-48, 1971. 13 fig, 22 ref.

Descriptors: *Rainfall-runoff relationships, *Sediment transport, *Vegetation effects, *Sediment yield, *Hydrologic data, Curves, Precipitation (Atmospheric), Soil properties, Topography, Vegeta-tion, Retardance, Overland flow, Streamflow, Temperature, Erosion, Conferences, Texas. Identifiers: *Vegetation-runoff-sediment relation-

General relationships between vegetation, runoff, and sediment yields are discussed. Runoff within each precipitation zone will vary widely because of differing biotic, geologic, and topographic fac-tors; nevertheless, a general relationship exists. Sediment yields do not show the same relationship to precipitation that runoff does. The responses of sediment yields and runoff to increasing precipita-tion are not easily interpreted. Sediment yields may be explained by two somewhat opposing fac-tors. Sediment transport tends to increase with in-creased precipitation but the opposing protective action of vegetation tends to become dominant in higher precipitation zones. Maximum sediment yields occur at about 12 inches of effective annual yields occur at about 12 inches of effective annual precipitation (data are adjusted to 50 deg F annual temperature) and become somewhat uniform at above 40 inches precipitation. If rainfall is increased in water shortage areas with less than 12 inches annual precipitation, erosion would be expected to increase. Of concern also is the period between increased rainfall and time necessary for plant cover to reach equilibrium with the new precipitation level. (See also W73-03066) (W73-03066) (W73-03066)

THE IMPACT OF WATER DEVELOPMENT ON THE ECOLOGY OF RIVER SYSTEMS, Texas A and M Univ., College Station.

W. J. Clark. In: Water for Texas; Proceedings of the 15th Annual Conference on Water for Texas, November 23-24, 1970, Texas A and M University, College Station: p 49-54, 1971.

Descriptors: "Urbanization, "Land use, "Environ-mental effects, "Ecology, "River systems, Con-struction, Sediment transport, Erosion, Erosion control, Sediment control, Planning, Watershed nanagement, Water quality, Ecosystems, Con-

Ecological implications of modifying the natural course of events in one part of the hydrological cy-cle, the river system, are discussed. The way man uses the land can modify the course of precipita tion after impact. It can determine how much penetrates, how much runs off and how long the runoff takes, and the nature and amount of trans ported material. Urbanization and land use practices can cause ecological differences between nent and intermittent streams. Th populations can only survive in the pools remain-ing, if any, and temperature and other conditions become extreme. It is a strange experience to study an intermittent stream when there is water flowing. To all appearances, it is a good aquatic habitat, but sampling shows it to be a biological desert. The effects of poor land use practices extend to the permanent streams as well. Runoff comes faster and causes more erosion. Water development projects will have widespread ecological effects. The nature of these effects ecological effects. The nature of these effects must be known if intelligent overall planning is to be done. Proper design, location and operation of dams and other structures may permit water supply goals to be obtained without serious ecological effects. (See also W73-03066) ecological effects. (Woodard-USGS) W73-03068

THE IMPACT OF WATER DEVELOPMENT ON

THE ECOLOGY OF BAYS AND ESTUARIES, North Carolina State Univ., Raleigh. B. J. Copeland, and T. J. Bechtel. In: Water for Texas; Proceedings of the 15th An-nual Conference on Water for Texas, November 23-24, 1970, Texas A and M University, College Station: p 55-90, 1971. 19 fig, 35 ref.

Descriptors: *Water resources development, *Water pollution, *Environmental effects, *Ecology, *Estuaries, Bays, Rivers, Industrial wastes, Municipal wastes, Agricultural chemicals, Ecosystems, Water quality, Nutrients, Organic matter, Streamflow, Saline water-freshwater interfaces, Fish toxins, Anadromous fish, Water quality control, Water pollution effects, Conferences, Texas.

A major task confronting water resources development projects is that of providing the necessary water for the particular project while at

the same time minimizing the ecological impact of such development on the immediate enviro Bayous, rivers and streams are the major pathways by which nutrients and organic material are transported into an estuary. There is a seasonal flux in the amount of nutrient and organic material being transported into estuaries, with the bulk of material entering on flood waters. The quality of material entering on flood waters. The quanty of inflowing waters, especially toxicity, influences the species diversity and productivity in the receiving estuary. A significant percentage of the marine organisms that compose the commercial catch of this country spend at least a portion of their life history in the coastal systems. Respirators of the commercial catch of the country spend at least a portion of their life history in the coastal systems. Respirators of the country is calculated to the coastal systems. ry dependence on freshwater input was calculated for the laboratory microecosystems. Calculations revealed that the estuary was 47%-78% dependent on river-borne organic material for the support of its respiration. Water resources development on the streams entering the oligonaline estuarine systems of the United States usually results in a decrease in productivity of these important coasts systems. (See also W73-03066) (Woodard-USGS) W73-03069

THE IMPACT OF WATER DEVELOPMENT ON ECOLOGY OF THE GULF OF MEXICO, Texas A and M Univ., College Station.

W. E. Pequegnat. In: Water for Texas; Proceedings of the 15th Annual Conference on Water for Texas, November 23-24, 1970, Texas A and M University, College Station, p 91-113, 1971. 12 fig. 2 tab, 17 ref.

Descriptors: *Water resources development, "Water pollution sources, "Environmental effects, "Ecology, "Gulf of Mexico, Industrial wastes, Municipal wastes, Oil industry, Oil spills, Ecosystems, Water pollution effects, Pollution abatement, Water quality, Reviews, Fish, Conferences, Texas.

The impact of water development on the ecology of the Gulf of Mexico is discussed. Emphasis is on those characteristics of the Gulf that affect its biological nature and that in the final analysis either accentuate or ameliorate those activities of man that impinge upon it continuing viability. These characteristics are discussed under the subheads of physiography, physicochemical oceanog-raphy, and biology. A possible way to minimize the deleterious effects of the rising trend to dispose of dangerous wastes in the coastal waters of all our shores is outlined. Potentially industrial wastes pose the most serious threat to the welfare of coastal waters. The multiplication of oil drilling towers on the shelf in the Gulf appears to be destined for unabated increases. There will be in creasing deposits of heavy metals and a variety of chlorinated and other hydrocarbons. Marine organisms through and because of the nature of the food web can concentrate and become relatively immune to some bacteria, viruses, heavy metals, and some hydrocarbons having carcinog perties. This can result in two things: 1) the list of marine organisms killed will increase, and 2) a larger reservoir of inedible species will be created. (See also W73-03066) (Woodard-USGS) W73-03070

METHOD FOR DETERMINING NUMBER OF BACTERIA IN OOZE DEPOSITS OF WATER RESERVOIRS (IN RUSSIAN), For primary bibliographic entry see Field 05A.

W73-03115

AGRICULTURAL WASTES IN ARID ZONES, New Mexico State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05F.

REMOTE S POLLUTION Geological St For primary b W73-03131

REMOTE SE TRW systems For primary t W73-03132

HYDROLOG AND LITTL COUNTY, NI Geological Su For primary b W73-03137

FRAUNHOFF PLIED TO W Geological Su For primary b W73-03140

SITES OF LIQUID-WAS NORTH QUA Geological Sur For primary b W73-03154

MAXIMUM SOLVED SO HARTFORD NECTICUT, Geological Sur For primary bi W73-03155

DISTRIBUTIO RENCE OF TA Clemson Univ Economic Zoo D.C. Sheppard M. Sc. Thesis, ref. OWRR A-0

Descriptors: *1 tion patterns, I tribution, Base Animal popular Identifiers: *F tions, Insect Abundance.

The seasonal tribution of ada flies, etc.) in Se Saluda-Santee mined. A total collected. Colle number of know species and s genera. The distrated on maps dicated graphics W72-03156

EFFLUENT AN OF A SYNTH WASSER UND KUNSTFASER? For primary bib W73-03157

BIOLOGIC PAI MISSION OF V New Hampshi Microbiology.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution—Group 5B

REMOTE SENSING OF ENVIRONMENTAL POLLUTION, Ceological Survey, Washington, D.C. For primary bibliographic entry see Field 05A. W73-03131

REMOTE SENSING OF WATER POLLUTION, TRW systems, Redondo Beach, Calif. For primary bibliographic entry see Field 05A. w72.0132

HYDROLOGIC RECONNAISSANCE OF BIG AND LITTLE SODA LAKES, CHURCHILL COUNTY, NEVADA, Geological Survey, Carson City, Nev. For primary bibliographic entry see Field 07C. W73-03137

FRAUNHOFER LINE-DEPTH SENSING AP-PLIED TO WATER, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05A. W73.03140.

SITES OF SOLID-WASTE STORAGE AND LIQUID-WASTE DISCHARGE, HARTFORD NORTH QUADRANGLE, CONNECTICUT, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-03154

MAXIMUM CONCENTRATION OF DIS-SOLVED SOLIDS IN SURFACE WATER, HARTFORD NORTH QUADRANGLE, CON-NECTICUT, Geological Survey, Washington, D.C.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-03155

DISTRIBUTION AND SEASONAL OCCUR-RENCE OF TABANIDAE ALONG A TRANSECT OF SOUTH CAROLINA, Clemson Univ., S.C. Dept. of Entomology and

Clemson Univ., S.C. Dept. of Entomology and Economic Zoology.

D.C. Sheppard.
M. Sc. Thesis, May 1972. 133 p, 88 fig, 2 tab, 42 ref. OWRR A-020-SC (13).

Descriptors: *Insects, *South Carolina, *Distribution patterns, Insect attractants, Entomology, Distribution, Baseline studies, Seasonal, Population, Animal population.

Animal population.

Identifiers: *Flies, *Tabanidae, *Insect populations, Insect traps, Horse flies, Deer flies, Abundance.

The seasonal occurrence and geographical distribution of adult Tabanidae (e.g. horse flies, dec.) in South Carolina, especially within the Saluda-Santee River drainage system, were determined. A total of 104 species and subspecies were collected. Collections of other workers bring the number of known South Carolina Tabanidae to 114 species and subspecies, distributed among 13 genera. The distribution of most species is illustrated on maps, and seasonal occurrence is indicated graphically. (LeGore-Washington) W7: 03156

EFFLUENT AND WATER QUALITY CONTROL OF A SYNTHETIC FIBER PULP MILL (AB-WASSER UND GEWAESSERSCHUTZ EINER KUNSTFASERZELISTOFFABRIK), For primary bibliographic entry see Field 05D. W73-03157

BIOLOGIC PARAMETERS IN WATER TRANS-MISSION OF VIRUSES, New Hampahire Univ., 'Durham, Dept. of Microbiology. For primary bibliographic entry see Field 05A. W73-03173

VIRUS-SIZED PARTICLE ADSORPTION ON SOIL-PART I: RATE OF ADSORPTION, Oregon State Univ., Corvallis. Dept. of Civil En-

gineering.
R. W. Filmer, M. Felton, Jr., and T. Yamamoto.
In: Virus and Water Quality: Occurrence and Control, Proceedings, Thirteenth Water Quality Conference, Illinois Univ., Urbana-Champaign, p 75-102, Feb 15-16, 1971. 5 fig, 13 tab, 7 ref.

Descriptors: *Water pollution, Ground water, *Soil bacteria, Adsorption, Diffusion, *Path of pollutants.

In order to investigate the mechanisms involved in the adsorption of viruses on soil, a study was made of the rate of adsorption. Some mathematical models were developed and compare with experimental data. Batch tests were carried out by employing radiotracer methods. The rate of adsorption of radioiodinated human serum on silica was interpreted as a diffusion-limited process. Some functional surfaces were obtained. (See also W73-03173) (Bean-AWWARF)

LABORATORY STUDIES ON THE SURVIVAL OF POLIOVIRUS IN ALGAL-BACTERIAL WASTEWATER TREATMENT SYSTEMS, California Univ., Berkeley. School of Public Health. For primary bibliographic entry see Field 05D. W73-03178

STUDY OF THE POLLUTION OF THE LAGOON AT TAHITI BY FECAL GERMS (IN FRENCH),

Hopital des Armees, Marseille (France).
J. P. Moreau, G. Feval, and R. Bagnis.
Rev Epidemiol Med Soc Sante Publique. Vol 19,
No 7, p 613-626. 1971. Illus. Maps. English summa-

Identifiers: *Waste disposal, *Fecal germs, Lagoons, Water pollution, *Tahiti, Wastes.

Samples of sea-water (138) were collected in the lagoon of Tahiti, in the zone where the population is the most dense. The collection was carried out by sampling the level of the shore, the channel, the reef, the surface H2O and the deep H2O. The frequency and density of total germs and fecal germs decreased from the surface toward the deep and from the shore toward the reef. The degree of pollution was minor and does not endanger either the biological equilibrium or the public health. However, the increase in population necessitates a particular waste disposal system to prevent untreated wastes from being poured into the sea.—Copyright 1972, Biological Abstracts, Inc. W73-d3181.

EFFECT OF DISSOLVED SALTS ON WATER SOLUBILITY OF LINDANE, Connecticut Univ., Storrs. Dept. of Chemistry. For primary bibliographic entry see Field 05G. W73-03185

THE ANTIBACTERIAL CAPABILITIES OF POLYHALOGENATED ION EXCHANGE RESINS,

Kansas State Univ., Manhattan. Div. of Biology. For primary bibliographic entry see Field 05F. W73-03187

THE USE OF QUATERNARY AMMONIUM RESIN-TRIIODIDE COMPLEX TO INAC-TIVATE VIRUS AND SELECTED BACTERIA, Kansas State Univ., Manhattan. Div. of Biology. For primary bibliographic entry see Field 05F. W73-03188

NITRATE TRANSFORMATIONS IN SURFACE WATERS; I. A STUDY OF VARIOUS FACTORS AFFECTING THE RATES OF DENITRIFICATION AND IMMOBILIZATION IN SURFACE WATERS, AND II. CHARACTERIZATION OF THE SURFACE WATERS IN THE WABASH RIVER AND THREE FARM PONDS, Purdue Univ., Lafayete, Ind.

L. B. Owens. M Sc Thesis, December 1972. 65 p, 8 fig, 16 tab, 30 ref, append. OWRR-A-019-IND (1).

Descriptors: *Denitrification, *Nitrates, *Anserobic bacteria, *Dissolved oxygen, Hydrogen ion concentration, Carbon, Temperature, Farm ponds, Path of pollutants, *Indiana, Water pollution sources. Identifiers: Organic carbon, *Wabash River (Ind).

In a series of experiments using surface water and culture media systems amended with nitrate and glucose, factors influencing denitrification were studied. The period of incubation required for denitrification to occur was decreased with increasing numbers of denitrifying organisms. Dissolved oxygen levels above 1 ppm reduced the rate of denitrification, and within an initial pH of 5.5 to 8.0, denitrification was independent of pH. At least 50 ppm of dissolved organic carbon was required for denitrification, with Ethanol the most efficient energy source tested. A water temperature of 10 C or higher was required. The water samples from three farm ponds and from upstream and downstream locations in the Wabash River indicated that: higher levels of denitrifying bacteria, nitrate, and phosphorus existed in the river than in the ponds; the ponds had more dissolved carbon; the nitrate levels did not exceed USPHS standards of 10 ppm; the river and pond surface waters were aerobic throughout the year; the levels of contaminants studied in the river were little affected by the municipal effluents added between the two river locations; and actual and potential denitrification rates appeared to be negligible without some type of amendment. (Nelson-Purdue University)

ENVIRONMENTAL GEOCHEMISTRY IN HEALTH AND DISEASE.

Geological Society of America Memoir, 123, Symposium. Maps. Geological Society of America: Boulder, Colo., 1971. 230 p. Illus. Pr. \$14.00. Identifiers: Books, Cattle, Diseases, Ecology, Environmental conditions, *Geochemistry, Geological, Health, Human, Medical, Plants, Society, *Symposium, *Zinc.

This book contains the papers from a symposium on environmental geochemistry held Dec. 30, 1968, in Dallas, Texas; these contributions attempt to illustrate that the chemistry of rocks, soils, plants and water in a particular geographic environment may be causally related, either directly to the occurrence of animal and human diseases. The data presented are representative of the state-of-knowledge in the field of geochemistry concerning the distribution of elements in various rocktypes of substrata, the dispersal of these chemical constituents in soils and water during weathering and their absorption by plants. With respect to biomedical problems, the information concentrates on medical ecology and the importance of geographic pathology in determining cause-effect relationships. Relationships of Zn to body growth and wound healing; Cd and hardness of water to heart disease; lead to multiple sclerosis; Cr to diabetes; Mo and Sr to dental caries; Ni, Cd, Cr, and asbestos to cancer; and Mo to molybdenosis of cattle are discussed.—Copyright 1972, Biological Abstracts, Inc. W73-03196

THE POISON CHAIN FOR MERCURY IN THE ENVIRONMENT, Middlesex Hospital Medical School, London (En-

Group 5B-Sources of Pollution

G. Kazants. Int J Environ Stud, Vol 1, No 4, p 301-306, 1971. Identifiers: *Path of pollutants, Birds, Chain, En-vironment, Exposure, Fish, Fungicides, *Mercu-ry, Mutagen, Toxicity, Teratogen, Public health.

ry, Mutagen, Toxicity, Teratogen, Public health.

The toxic effects of Hg in specific population groups, for example following occupational exposure or therapeutic application, has long been known, but Hg as a general environmental hazard has followed comparatively recent technological development. Contamination with both inorganic and organic Hg compounds resulted from industrial waste and from the use of the latter compounds as fungicides. Deposited eventually in rivers and lakes, this led to raised levels of Hg in fish. Under appropriate conditions, methylation of Hg may occur in the natural environment, converting less toxic inorganic and aryl Hg compounds into the more toxic alkyl mercury form. In certain predominantly fish eating populations this led to an increase in the body burden for organic Hg, resulting in localized outbreaks of methyl Hg poisoning. Raised levels of mercury in eggs and bird tissues resulted from feeding on Hg contaminated fish and on organomercury treated seed. This has contributed to a reduction in some species of birds in certain areas. In addition to the direct toxic action of Hg, limited evidence sugests that methyl Hg compounds may possibly exert mutagenic and teratogenic effects, at levels below those usually associated with poisoning. Methyl Hg concentration should be monitored exposed groups and where this is raised, epidemiological studies performed to evaluate a posed groups and where this is raised, epidemiological studies performed to evaluate a possible hazard.—Copyright 1972, Biological Abstracts. Inc. W73-03202

ENVIRONMENTAL MONITORING AS-SOCIATED WITH DISCHARGES OF RADIOAC-TIVE WASTE DURING 1969 FROM UKAEA

ESTABLISHMENTS.
United Kingdom Atomic Energy Authority, Harwell (England). Authority Health and Safety Branch.

Report AHSB RP R 105, 1967. 22 p, 19 tab, 7 ref.

Descriptors: "Radioactive wastes, "Effluents, "Sampling, "Monitoring, "Radioactive waste disposal, Liquid wastes, Mik, Strontium radioisotopes, Cesium, Fallout, Iodine radioisotopes, Salmon, Shrimp, Crabs, Lobsters, Mussels, Radium radioisotopes, Crustaceans, Wastes reclusion of feet." Water pollution effects.

Water ponution effects.

Identifiers: Seaweed, White fish, Limpets,
Periwinkle, Ruthenium, Cerium, Zirconium,
Niobium, Graphite, Radon, Thames River.

This summary of the monitoring programs which have been carried out in connection with the discharge of radioactive wastes from the principal establishments of the UKAEA in 1969, includes establishments of the UKAEA in 1969, includes the essential features of the authorizations for such discharges, the details of the actual discharges, and the results of environmental monitoring. The appendix contains the general principles governing the control of discharges of all forms of radioactive waste to the environment and of the nature of possible hazards which might arise as a consequence of these discharges. Evidence is presented to demonstrate that in 1969 radioactive waste discharged from UKAEA establishments were well below authorized limits in almost all cases and that no person was exposed to radiation doses exceeding recommended acceptable levels. (Holoman-Battelle)

SOME SPECIES OF PHYLLODOCIDAE, SYL-SUME SPECIES OF PHYLLODOCIDAE, SYLLIDAE, NEPHTYIDAE, GONIADIDAE, APISTOBRANCHIDAE AND SPIONIDAE (POLYCHAETA) FROM THE NORTHEAST PACIFIC OCEAN, Washington Univ., Seattle. Dept. of OceanogK. Banse. Available from the National Technical Informa-tion Service as RLO-1725-203, \$3.00 in paper copy, \$0.95 in microfiche. Report No RLO-1725-203, (1971). 81 p, 11 fig, 64 ref. Contract No AEC AT (45-1)-1725.

Descriptors: *Annelids, *Pacific Ocean, *Systematics, *Speciation, Marine animals, Ecological distribution, Spatial distribution. Identifiers: *Polychaetes, Macroinvertebrates.

Polychaetous annelids were studied in collections from various museums and from Washington waters. The study of the types of incompletely described specimens is reported along with the description of two new species. Additions to the descriptions of other species were made, and seven new records for the cool-temperate northeast Pacific Ocean are given. (Holoman-Bat-stle) W73-03221

5C. Effects of Pollution

IDENTIFICATION OF TOXIC COMPONENTS IN OIL REFINERY EFFLUENTS AND DETER-MINATION OF THEIR EFFECT UPON THE AQUATIC BIOTA, Oklahoma Water Resources Research Center,

For primary bibliographic entry see Field 05A. W73-02609

APPLICATION OF BIOLOGICAL MONITOR-ING SYSTEMS TO SIMULATED INDUSTRIAL WASTE DISCHARGE SITUATIONS, Virginia Polytechnic Inst. and State Univ., Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. J. Cairns, Jr., E. L. Morgan, and R. E. Sparks. Available from the National Technical Information Service as PB-213 468, \$3.00 in paper copy, \$0.95 in microfiche. Virginia Water Resources Research Center Completion Report, August 1972. 14 p, 3 fig, 3 tab. OWRR A-039-VA (2).

Descriptors: *Bioindicators, Fish physiology, Fish behavior, *Industrial wastes, Toxicity, Water pol-lution effects, *Monitoring, Heavy metals, *Calci-um, Copper, Zinc, *Sunfishes, Water tempera-ture, Dissolved oxygen, Hydrogen ion concentra-tion, *Simulation analysis.

Environmental factors such as temperature, calci-um concentration, pH and dissolved oxygen con-centration have been shown to modify the toxicity of zinc, copper, and other heavy metals to fish. Since these factors interact, and because stream Since these factors interact, and because stream characteristics and industrial waste characteristics vary, it becomes difficult to rapidly predict the toxicity of zinc and other materials to aquatic organisms at an industrial or municipal facility from physical-chemical data alone. Techniques were developed and applied for measuring the breathing rates and movement activities of fish. These responses were analyzed to determine if stress responses occur to complex environmental changes. Calcium at 147 mg/l did not cause continued stress detections. Bluegills did not become incapable of responding to a simulated zinc spill (3 mg/l) after long term exposure (41 weeks) to what meapage of responding to a simulated 2mc spin (smg/1) after long term exposure (41 weeks) to what is presumed a biologically safe concentration (0.75 mg/1). Calcium (110 mg/1) does act antagonistically with zinc (3.7 mg/1) and copper (.3 mg/1) does not appear to act synergistically with 1.4 mg/1 zinc. A daily change in temperature of 5 degrees C did produce a number of detections when no toxidid produce a number of detections when no toxi-cant was present. However, when the first tem-perature treatment day is used to establish baseline breathing rates then no detections are ob-tained on the following treatment days. These biological monitoring techniques should be ap-plicable in field situations for detecting not only heavy metals, but other toxicants as well.

EFFECTS OF DETERGENT POLLUTED WATER ON SOIL REACTION AND PLANT

GROWTH, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.

Blactsourg, Dept. of CVR Indianatoria.

W. Kroontje.

Available from the National Technical Information Service as PB-213 469, \$3.00 in paper copy, \$0.95 in microfiche. Virginia Water Resources Research Center, Completion Report, August 1972, 8 p. OWRR A-041-VA (1).

Descriptors: Municipal wastes, *Detergents, Soil types, Soil contamination, Irrigation, *Crop response, *Corn (Field), *Water pollution effects, Ysoil contamination effects.

Identifiers: Soluble salts.

A greenhouse experiment was conducted to determine the effects of two detergents on the growth of corn (Zea mays L.) when individually applied to of corn (Zea mays L.) when individually applied to Davidson clay loam and Norfolk fine sandy loam. The detergents were a heavy-duty non-enzyme detergent (Bz) and a heavy-duty enzyme detergent (Tx). They were applied in the watering solutions at concentrations of 0, 20, 800, 1600, 4800, 8000, 10,000, 12,000, and 14,000 ppm. Stimulations in growth occurred on the Davidson soil that received 1600 ppm Bz and 800, 1600, 4800, and 8000 ppm Tx and on the Norfolk soil that received 800 ppm Tx. These stimulations were attributed to responses to P contained in the detergents. Yield decreases were noted on the Davidson soil that responses to P contained in the detergents. Yield decreases were noted on the Davidson soil that received 8000, 10,000, 12,000, and 14,000 ppm Bz and 14,000 ppm Tx and on the Norfolk soil that received 1600, 4800, 10,000, 12,000, and 14,000 ppm Bz and 4800, 8000, 10,000, 12,000, 14,000 ppm Tx. These detrimental effects were attributed to soluble salt damage from the Na contained in the detergents on all treatments except where Tx was applied to the Norfolk soil. In the latter case, except the Norfolk soil in the latter case, sould not be separated from was applied to the Norfolk soil. In the latter case, specific Na effects could not be separated from general salinity effects. Plants grown on the Davidson soil were more tolerant to detergent applications than those grown on the Norfolk soil, probably because of the larger cation exchange capacity and greater surface area of the Davidson soil. Soil pH or B in the detergents was not responsible for the yield decreases. (Johnson-Virginia) W73.07607. W73-02620

PERIPHYTON AND PHYTOBENTHON AS IN-DICATORS OF WATER QUALITY, Rhode Island Univ., Kingston. Water Resources

Center. For primary bibliographic entry see Field 05B. W73.02625

MODELING DISCHARGE AND CONSERVA-TIVE WATER QUALITY IN THE LOWER KAN-SAS RIVER BASIN, Kansas Univ., Lawrence. Dept of Civil Engineer-

For primary bibliographic entry see Field 04A. W73-02658

THE ROLE OF ZOOBENTHOS IN THE FEED-ING OF BOTTOM-FEEDING FISH AND THE FOOD SUPPLY AFTER THE DAMMING OF THE DON (IN RUSSIAN), Azovo-Chernomorskii Selskokhozyaistvennyi In-

stitut, Rostov-na-Donu (USSR). For primary bibliographic entry see Field 02L. W73-02677

GROWTH CHARACTERISTICS, STRUCTURE AND ABUNDANCE OF ABRAMIS BRAMA (L.) IN THE WATER PASSAGES OF THE SUMMER IN THE WATEK PASSAGES OF THE NYAMUNUS DELTA (IN RUSSIAN), Akademiya Nauk Litovskoi SSR, Vilnius. Institut Zoologii i Parazitologii. K. S. Gaigalas, and D. P. Blatnene. Vopr Ikhtiol. Vol 11, No 5, p 794-805. 1971. Illus.

Identifiers: Cestode, De *Nyamunus d

The effect of maturation, fe cestode pleur abundance of of the summe vival of fish o next year was activity, winte Copyright 1972 W73-02678

REPRODUCT LAMPREY I HYDROCONS RUSSIAN), A. S. Agamalie Tr Molodykh I Rybn Khoz O Identifiers: (USSR), *Lan am construct

Hydroconstru basin caused range of the caused a catas a decrease in Caspian lampr cupied by any its tributaries was the most v ditions of regulical Abstracts, W73-02684

A LABORAT OF DIELDRI TEBRATES, Plant Protecti Africa). J. H. Van Jaar Phytophylacti Identifiers: water), *Toxic

The susceptible tebrates (Turb ta, Mollusca) parison and di and benthic f namely an em are presented ship between ecological nich most toxic (Ephemeropte and worms we -Copyright 197 W73-02695

LOW LEVEL SALMON. AN Washington U L. R. Donalds Hershberger. Available from 2225-T-2-3; microfiche. Re p, 8 fig, 12 tab

Descriptors: * mon, *Sexu Anadromous physiology, G

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Effects of Pollution-Group 5C

Identifiers: *Abramis brama, Abundance, Cestode, Deltas, Growth (Fish), Marshes, *Nyamunus delta (USSR), Passages, Summer, USSR, Winter, Water pollution effects, *Golden

The effect of water pumping on growth, sexual maturation, feeding, resistance to infection by cestode pleurocercoides and the structure and abundance of golden shiners in the water passages of the summer marshes of the Nyamun was studied. Yearly hay productivity and the survival of fish of different size until spring of the next year was closely related to the water pump activity, winter conditions, and water pollution. Copyright 1972, Biological Abstracts, Inc. W73-02678

REPRODUCTION OF THE CASPIAN LAMPREY IN THE KURA BASIN UNDER HYDROCONSTRUCTION CONDITIONS, (IN

RUSSIAN),
A. S. Agamaliev.
Tr Molodykh Uch Vses Naucho-Issled Inst Morsk Rybn Khoz Okeanogr. 4. p 112-118. 1970. English

Identifiers: *Caspian lamprey, *Kura (USSR), *Lamprey, Reproduction (Fish), USSR, Dam construction, Water pollution effects.

Hydroconstruction in the rivers of the Caspian Hydroconstruction in the rivers of the Caspian basin caused a sharp decrease in the spawning range of the Caspian lamprey, which in turn caused a catastrophic decrease in its reserves and a decrease in catches. The ecological niche of the Caspian lamprey is so specific that it cannot be occupied by any other fish. Studies of the Kura and its tributaries showed that the Aldzhiganchai River was the most valuable for breeding under new constitution of resulted flow. Conversit 1977, Biological Caspidal Cas ditions of regulated flow .-- Copyright 1972, Biological Abstracts, Inc. W73-02684

A LABORATORY STUDY ON THE TOXICITY OF DIELDRIN TO FRESH WATER INVER-TEBRATES,

Plant Protection Research Inst., Pretoria (South Africa).

J. H. Van Jaarsveld.

Phytophylactica. Vol 2, No 4, p 269-274. 1970. Il-

Identifiers: *Dieldrin, *Invertebrates (Freshwater), *Toxicity, Water pollution effects.

The susceptibility of various fresh water invertebrates (Turbellaria, Annelida, Crustacea, Insecta. Mollusca) to dieldrin was determined. A comparison and discussion of the reactions of surface and benthic fauna to 2 formulations of dieldrin, namely an emulsifiable concentrate and a solution, are presented. Results revealed a close relationship between the reaction of dieldrin and the ecological niche of the invertebrates. Dieldrin was most toxic to immature stage of insects (Ephemeroptera and Trichoptera) while molluses and worms were more resistant to the insecticide.— Copyright 1972, Biological Abstracts, Inc. W73-02695

LOW LEVEL CHRONIC IRRADIATION OF SALMON. ANNUAL PROGRESS REPORT, Washington Univ., Seattle, Coll. of Fisheries. L. R. Donaldson, K. Bonham, and W. K.

Hershberger. Available from NTIS, Springfield, Va., as RLO-2225-T-2-3; \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-2225-T-2-3, June 1972. 35 p, 8 fig, 12 tab, 2 ref. AEC-AT (45-1)-2225.

Descriptors: "Radioactivity effects, "Chinook sal-mon, "Sexual maturity, "Growth stages, Anadromous fish, Fish behavior, Life cycles, Fish physiology, Gamma rays,

The number of adults returning over a 5-year period was unaffected by exposure of the smolts during the brood year 1966 to 2.8 rads/day for a total of 235 rads. However, it is expected that fewer will return of those irradiated in later brood years to 10-50 rads/day. Retardation in gonadal development of premigratory smolts was produced by 10 rads/day. A lack of spermatoonia or oogonia in the histological sections of fingerlings was produced by 20 rads/day. Further study is expected to reveal quantitative relation-ships between gonadal conditions and irradiation damage to other tissues. Additional facilities were installed for rearing the young fish for an ex-panded program to evaluate delayed genetic ef-fects. (Bopp-ORNL) W73-02714

TRITIUM AND ITS EFFECTS IN THE EN-VIRONMENT - A SELECTED LITERATURE SURVEY.
Battelle Memorial Inst., Columbus, Ohio. Colum-

Available from NTIS, Springfield, Va., as BMI-171-203; \$6.00 paper copy, \$0.95 Microfiche. Report No BMI-171-203, June 30, 1971. 378 p, 3 indices.

Descriptors: *Tritium, *Radioactivity, *Bibliographies, *Abstracts, *Environmental effects, *Biology, Human population, Public health.

A bibliography was compiled to provide detailed subject access to the literature on tritium and its effects in the environment with emphasis on man. The abstracts are, for the most part, of the indicative type-intended to describe the content of the references without relating specific details. All index terms associated with each article are listed in the compilation immediately following the abstract. To provide access to the contents of the compilation, a subject, author, and report-number index are provided. (Houser-ORNL) W73-02720

WASTE REPOSITORY. RADIOACTIVE LYONS, KANSAS, (FINAL ENVIRONMENTAL IMPACT STATEMENT).
Atomic Energy Commission, Washington, D.C.

Available from NTIS, Springfield, Va., as PB-202 120-F, \$6.00 paper copy, \$0.95 microfiche. June 1971. 342 p, 12 fig, 9 tab, 73 ref, 1 app.

Descriptors: *Nuclear wastes, *Radioactive waste disposal, Waste treatment, *Water pollution, *Solid waste, Ecology, Hydrology, Geology, Subsurface water, Thermal properties, Heat conduc-tivity, Environmental effects, Public health, Radioactivity effects, *Kansas. Identifiers: *Salt mine disposal, *Environmental

impact statements, *Lyons (Kansas).

As nuclear power assumes an increasingly impor-tant role in meeting the nation's requirements for electrical energy, the quantity of radioactive wastes will also increase. The wastes of primary concern - designated 'high-level' and wastes - contain radioactive nuclides that decay so slowly as to require that they be isolated from the biosphere for thousands of years. The initial measures to be taken as a part of the Commission's overall waste-management policy and program for the permanent disposal of these wastes are described. The proposed facility will safely con-tain these wastes for the required period of time without any significant impact on the environ-ment. (Houser-ORNL) W73-02721

SYMPOSIUM ON RADIOECOLOGY APPLIED TO THE PROTECTION OF MAN AND HIS EN-

European Communities, Luxembourg, Commis-For primary bibliographic entry see Field 05B.

RUIGG DISTRIBUTION IN A REDUCED MODEL SIMULATING RIVER BANKS; SOME HYDRODYNAMIC AND KINETIC ASPECTS OF ITS ADSORPTION ON SEDIMENTS (REPARTI-ITS ADSORFILON ON SEDIMENTS (REPARTITION DU RUIGE DANS UN MODELE REDUTTION DU RUIGE DANS UN MODELE REDUTSIMULANT LES BERGES D'UNE RIVI ERES), Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Études Nucleaires. For primary bibliographic entry see Field 05B. W73-02724

PROGRESS REPORT, BIOLOGY AND HEALTH PHYSICS DIVISION, ENVIRONMENTAL RESEARCH BRANCH, JANUARY 1972 TO

MARCH 31, 1972, Atomic Energy of Canada Ltd., Chalk River (On-tario). Chalk River Nuclear Labs. C. A. Mawson.

Report available from NTIS, Springfield, Va., as AECL-4213; \$3.00 paper copy, \$0.95 microfiche. In: Report AECL-4213, p 29-41, June 1972. 3 fig, 1

Descriptors: "Nuclear wastes, "Canada, "Environmental effects, "Radioactivity effects, Water analysis, Carbon radioisotopes, Primary productivity, Radioecology, Cores, Sediments, Lakes, Rivers, Thermal pollution, Nuclear powerplants, Radioactivity techniques, Tritium, Radioisotopes, Absorption, Food chains, Phytoplankton, On-site investigations, Ultimate disposal, Weathering, Leaching, Path of pollutants, *St. Lawrence River.

Low-power operation of the Gentilly nuclear powerplant on the St. Lawrence River did not affect chemical, physical, and biological conditions between two upstream and five downstream sampling stations. Preliminary laboratory studies indicate that increased lake-water temperature and added nutrients may adversely influence primary C14 fixation. Radiochemical analysis of Lake Ontario sediment showed readily measurable Cs137 and Sr90, detectable Ce144, but no Ru106 or Zr95. Counting by a Ge (Li) detector-pulse height method showed Cs137, Ce144, and daughter products of Ra and Th in a dried sediment core from Lake Erie. Other studies include a tritiumtracer method for determining lake evaporation, on- and off-site radiation monitoring, fate of radionuclides in aquatic ecosystems, neutron-ac-tivation analysis of trace elements in water samples, leaching of high-level wastes from glass blocks, and radiation-dose implications as a result of the release of radioactive wastes. (Bopp-ORNL) W73-02725

LONG TERM RELEASE OF RADIOACTIVITY FROM RAINIER MELT-GLASS, Teledyne Isotopes, Las Vegas, Nev. For primary bibliographic entry see Field 05B. W73-02727

ENVIRONMENTAL DYNAMICS OF MERCU-Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 05B. W73-02729

PROCEEDINGS OF SOUTHERN CONFERENCE ON ENVIRONMENTAL RADIATION PROTEC-

Group 5C-Effects of Pollution

TION FROM NUCLEAR POWER PLANTS, APRIL 21-22, 1971.
Environmental Protection Agency, Washington, D.C. Office of Radiation Programs.
For primary bibliographic entry see Field 05B.
W73-02732

EVALUATION OF ENVIRONMENTAL FAC-TORS AFFECTING POPULATION EXPOSURE, Battelle-Pacific Northwest Labs., Richland, For primary bibliographic entry see Field 05B. W73-02733

AQUATIC RADIOLOGICAL MONITORING BROWNS FERRY NUCLEAR PLANT, Tennessee Valley Authority, Muscle Shoals, Ala. Div. of Environmental Research and Develop-For primary bibliographic entry see Field 05B.

AN ECOLOGICAL APPROACH TO MARINE RADIOLOGICAL MONITORING AT THE FLORIDA POWER CORPORATION CRYSTAL

RIVER NUCLEAR PLANT, Florida Univ., Gainesville. Dept. of Zoology. For primary bibliographic entry see Field 05B. W73-02737

TROUBLED WATERS, LAKE ERIE 1971, Social Technology Systems, Inc., Newton, Mass. For primary bibliographic entry see Field 05B. W73-02743

ANNUAL REPORT OF THE EASTERN EN-VIRONMENTAL RADIATION LABORATORY, JANUARY-DECEMBER 1970. Eastern Environmental Radiation Lab., Montgomery, Ala.

For primary bibliographic entry see Field 05B. W73-02744

W73-02736

RADIOACTIVE AND STABLE NUCLIDES IN THE COLUMBIA RIVER AND ADJACENT NORTHEAST PACIFIC OCEAN, Oregon State Univ., Corvallis. Dept. of Oceanog-

For primary bibliographic entry see Field 05B. W73-02745

RADIONUCLIDE CYCLING IN NATURAL POPULATIONS OF AMPHIBIANS. ANNUAL PROGRESS REPORT, JUNE 16, 1971 - JUNE 15,

Oregon State Univ., Corvallis. Dept. of General

Available from NTIS, Springfield, Va., 12 RLO-2227-T-8-3; \$3.00 in paper copy, \$0.95 in microfiche. Report RLO-2227-T-8-3, 1972. 17 p, 19 fig, 4 ref. AEC AT- (45-1)-2227.

Descriptors: *Amphibians, *Newts, *Radioisotopes, *Radioactivity effects, Absorption, Food chains, Path of pollutants, Radioecology, Water pollution effects, Nuclear wastes, Aquatic habitats.

Identifiers: Chromium radioisotopes, Manganese radioisotopes, Tungsten radioisotopes, Cesium

One of the purposes was to study this source in the food chains of their predators. Radionuclide uptake by newts from water, and retention half-tin after uptake from water, food, or by injection were measured. Studies are commencing of frogs developing in water containing 0.001-0.1 microCuries/ml of Cs134. Whole body concentration factors for newts were: for W at 10 C, 12; for W at 23 C, 5; for Mn at 10 C, 2.2; for Mn at 23 C, 5.9. In all cases the majority of the long-term body burden was in the soft (edible) tissues. Equilibrium uptake from water was reached in 5-10 days with W and Cr, but was not reached in 25 days with Mn. For uptake by newts from water the long-term retention half-times and the percentage of the total uptake with the long-term retention were: W at 10, 24 days, 2%; W at 23 C, 107 days, 6-7%; Mn at 10 C, 250 days, 40%; Mn at 23 C, 55 days, 50%. (Bopp-ORNL)
W73-02755 C. 5; for Mn at 10 C, 2.2; for Mn at 23 C, 5.9. In all

THE INFLUENCE OF THERMAL ACCLIMA-TION ON THE RELATION BETWEEN OX-YGEN CONSUMPTION AND TEMPERATURE IN LITTORINA LITTOREA (L.) AND MYTILUS

EDULIS L., Queen Mary Coll., London (England). Dept. of Zoology and Comparative Physiology. R. C. Newell, and V. I. Pye. Comparative Biochemistry and Physiology, Vol 34, No 2, p 385-397, May 15, 1970. 6 fig, 19 ref.

Descriptors: *Marine biology, *Oxygen demand, *Temperature, *Animal metabolism, Metabolism, *Mussels, Water temperature, Seasonal. Identifiers: *Oxygen consumption, *Thermal acclimation, Thermal tolerance, Temperature variations, Seasonal adjustment, *Winkles.

Storage of winkles at raised temperatures results in an increase in the temperature at which the ther-mal optima of the active and standard rates of oxyear consumption occur. The temperature range over which metabolic compensation of the stan-dard rate occurs is also controlled by the acclimation temperature. At least two phenomena accom-pany the process of thermal acclimation in cellfree homogenates of winkles and mussels. The first, occurring after 2 days, involves an alteration in the thermal tolerance, or a point beyond which a decline in oxygen consumption occurs. After 7 days a Q sub 10 of less than 1.2 is developed. (Oleszkiewicz-Vanderbilt)

TEMPERATURE SENSITIVITY OF TWO SPE-CIES OF INTERTIDAL FISHES, San Diego State Coll., Calif. J. B. Graham.

Copeia, No 1, p 49-56, March 2, 1970. 9 fig, 21 ref.

Descriptors: *Fish, *Temperature, Heat, California, *Thermal pollution, Metabolism, Bioassay, Habitats, Surface waters, Environmental effects,

Seasonal adaptation.
Identifiers: *Temperature sensitivity, Seasonal temperature variations, Oxygen consumption.

Clinocottus analis and Hypsoblennius gilberti have similar latitudinal distributions in the eastern smilar lattudinal distributions in the eastern Pacific Ocean and occur together in the intertidal environment from central California to Baja California. Although they occupy similar habitats in the temperate zone, these two species differ in origin. C. analis belongs to the predominantly boreal family Cottidac, H. gilberti is a member of the primarily tropical family Blenniidae. Because of these differing ancestries, these two species or these differing ancestries, these two species have undergone different processes in adapting to the same habitat. The mechanisms of adaptation for C. analis involve accommodation to warm temperatures, and for H. gilberti, accommodation to cold. Both species demonstrate seasonal acclimatization. C. analis has a greater tolerance to cold temperatures than H. gilberti which, as expected, temperatures than H. gibert which, as expected, has a greater tolerance for warm temperatures. H. giberti is able to acclimate completely to 12 degrees C in the winter; however, this can not be done in summer. C. analis, however, was able to acclimate completely to 12 degrees C during both seasons. Acutely determined metabolism studies indicated that both species compensate for seasonal temperature changes by adjusting their metabolic rates. (Oleszkiewicz-Vanderbilt) W73-02762

BIOLOGICAL ASPECTS OF THERMAL POL-LUTION, II. SCIENTIFIC BASIS FOR WATER TEMPERATURE STANDARDS AT POWER PLANTS.

Oak Ridge National Lab., Tenn. C. C. Coutant.

Critical Reviews in Environmental Control, Vol 3, Issue 1, p 1-24, August 1972. 6 fig, 2 tab, 104 ref.

Descriptors: *Water temperature, *Water quality standards, Biology, *Aquatic habitats, *Thermal pollution, Bioassay, Heat, Thermal powerplants, pollution, Bioassay, Heat, I nermal powerplants, Water pollution, Environmental effects, Cooling, Mixing, Standards, Biological communities, Diversification, Reproduction, Outlets, Jets. Identifiers: *Temperature standards, *Biological

This review outlines water temperature requirements of aquatic organisms that seem most pertinent to establishing water temperature standards. Emphasis is placed on thermal modifications by power plants and on the dynamic ecological setting of such modifications. Review of the scientific literature on temperature effects on fish and other aquatic organisms has revealed an extensive aquatic organisms has revealed an extensive framework of knowledge that is clearly superior to that available for most other environmental modifications. Most present water temperature standards are too simplistic and do not reflect this knowledge. As a result, much current research is knowledge. As a result, much current research is not directed toward the most pertinent ecological questions and power station designers are often not fully utilizing predictive capabilities now available for minimizing thermal impacts. (Olesz-kiewicz-Vanderbilt) W73-02766

THERMAL EFFECTS OF THE SURRY NUCLEAR POWER PLANT ON THE JAMES RIVER, VIRGINIA; PART II: RESULTS OF MONITORING PHYSICAL PARAMETERS OF THE ENVIRONMENT PRIOR TO OPERATION,

Virginia Inst. of Marine Science, Gloucester Point. S. N. Chia, C. S. Fang, R. L. Bolus, and W. J. Hargis, Jr.

Special Report in Applied Marine Science and Ocean Engineering Number 21, February 1972. 343 p, 50 fig, 3 tab.

criptors: *Temperature, *Physical properties, Descriptors: Temperature, "Physical properties," Thermal powerplants, Thermal pollution, Instrumentation, Data collections, Fathometers, Water quality, Currents (Water), Water pollution, Current meters, Powerplants, On-site data collections, "Virginia.

Identifiers: *Thermal effects, *James River, Dew point hygrometers, Thermal discharges, Tempera-ture distribution patterns.

The thermal structure of the James River Estuary The thermal structure of the James River Estuary was studied in the area of the future discharges from the nuclear power plant at Hog Point is Surry County, Virginia. The plant is scheduled to become operational with one unit generating 800 MW in the summer of 1972 and with a second identical unit in the spring of 1973. This study will help to evaluate the potential environmental effects from the waste heat discharged from the power plant when it becomes operational. The thermal field adjacent to the intended discharge area and the thermal distributions in the estuary have been plotted for the spring, summer, and fall area and the thermal distributions in the estuary have been plotted for the spring, summer, and fall of 1971. These plots will be used as the natural background data for future comparisons with plots made after the plant becomes operational. From such comparisons it will be possible to determine whether or not the plant will have significant effects on the thermal regime. Likelihood of biological damage in that part of the James River Estuary will then be possible to assess. An extensive appendix of field data is included for seven locations. (Oleszkiewicz-Vanderbilt) ELECTRIC THE FUTU

Future Shap ture Shape

Descriptors: *Air pollutional power *Nuclear pomental effect water, Elect production, Reactors, W Identifiers: *Criteria, *C

This publicat energy supp tended to p between the trical energy be met - bo resultant imp of energy s need for reli necessity of technological for the future this study are lands, the co (MW per sq. l sis has been more than ju demand and Biological e Biological eff mental effect W73-02769 tl derbilt) W73-02768

ELECTRICA SUPPLY, Joint Labs. of lands, Arnhen J. H. Bakker, In: Electrical Problems, No. Technology P Technology F p8-15, April 19

Descriptors: 4 power produc mal pollution, Forecasting, E Reactors, Tran Identifiers: netohydrodyna

The demand for still faster rate sumption in ge tric power is | stations, using production is cooling water pollution by units can be areas, and so e fuel inside pop use of energy These facts ma electricity cons production bree ated. Fast bree sidered possible sion reactors ar cal. Various ELECTRICAL ENERGY NEEDS AND EN-VIRONMENTAL PROBLEMS, NOW AND IN THE FUTURE.

Future Shape of Technology Publication No 7, Future Shape of Technology Foundation, The Hague, April 1971, 67 p.

Descriptors: "Electric power, "Thermal pollution, "Air pollution, "Europe, "Water pollution, "Thermal powerplants, "Heated waters, "Cooling, "Nuclear powerplants, Plants, Animals, Environmental effects, Forecasting, Economics, Cooling water, Electric power demand, Electrical power production, Fish, Aquatic habitats, Standards, Reactors, Water temperature. Identifiers: "Biological effects, "The Netherlands, "Criteria, "Combustion, "Waste heat utilization.

This publication is one of three dealing with future energy supply, that will appear in 1971. It is in-tended to promote insight into the interrelation tended to promote insight into the interrelation between the constantly growing demand for elec-trical energy, the ways in which this demand can be met - both now and in the future - and the resultant impact on the environment. Extensions of energy supply systems have to meet joint requirements imposed by economic criteria, by the need for reliability and safety, as well as by the need for reliability and safety, as well as by the necessity of protecting the environment. Present technological and economic limitations are ex-amined and the feasibility of alternative solutions for the future is discussed. Many examples used in this study are based on the situation in the Netherlands, the country with the highest power density (MW per sq. km.) in the world. However the analysis has been made in such a way as to make it of more than just national importance. Six papers cover the following topics: (1) Electrical energy demand and supply, (2) Discharge of waste heat, (3) Air pollution from combustion products, (4) Biological effects of thermal discharges, (5) Biological effects of air pollution, and (6) Environmental effects of nuclear power production. (See W73-02769 thru W73-02774) (Oleszkiewicz-Van-W73-02768

ELECTRICAL ENERGY, DEMAND AND

SUPPLY,
Joint Labs. of the Electric Utilities in the Nether-

J. H. Bakker, and J. J. Went.

J. H. Bakker, and J. J. Went. In: Electrical Energy Needs and Environmental Problems, Now and in the Future, Future Shape of Technology Publication No. 7, Future Shape of Technology Foundation, The Hague, Chapter 1, p8-15, April 1971. 4 fig, 2 tab.

Descriptors: *Electric power demand, *Electric power production, *Thermal powerplants, Thermal pollution, Powerplants, Nuclear powerplants, Forecasting, Economics, Fossil fuels, Generators, Reactors, Transmission (Electrical).

Identifiers: Thermionic generators, netohydrodynamics

The demand for electrical energy is increasing at a still faster rate than the growth of energy con-sumption in general. To satisfy the demand, electric power is produced mainly in thermal power stations, using fossil or nuclear fuel. This kind of production is connected with the heating up of cooling water and - for fossil fuel plants - with air pollution by combustion products. Production pollution by combustion products. Production units can be placed outside heavily populated areas, and so environmental effects can be better controlled than with direct combustion of fossil fuel inside populated areas. Electricity is a clean use of energy at the place where it is needed. These facts may lead to a still larger growth rate of electricity consumption. For future electric power production breeder and fusion reactors are evaluated. Fast breeders and thermal breeders are considered possible for use in this century while fusion reactors are not expected to become economical. Various direct conversion methods are

discussed. Magnetohydrodynamic generators require such high temperatures that satisfactory structural materials are not yet available. structural materials are not yet available. Photoelectric generators and thermoelectric cells would require storage methods not yet developed to be usable throughout the entire day. Thermionic convertors and electrochemical fuel cells can be of e for very small power sources. The use of heat and electricity produced simultaneously is discussed. (See also W73-02768) (Oleszkiewicz-Vanderbilt) W73-02769

DISCHARGE OF WASTE HEAT,

Joint Labs. of the Electric Utilities in the Netherlands, Arnhem.

R. J. Keller.

In: Electrical Energy Needs and Environmental Problems, Now and in the Future, Future Shape of Technology Publication No. 7, Future Shape of Technology Foundation, The Hague, Chapter 2, p 17-24, April 1971. 3 fig, 2 tab, 12 ref.

Descriptors: *Heated water. *Heat. *Thermal poldution, Thermal powerplants, Electric power, Cooling, Cooling towers, Europe, Fisheries, Agriculture, Economics, Fish farming, Shrimps, Beneficial use.

Identifiers: *Waste heat utilization, The Nether-

lands. Heat use.

In the next decades electric power will still have to be produced with steam powered turbines, im-plicating a need for cooling water. Demands for cooling water can be met by once through fresh or salt water cooling, by surface cooling or by cooli towers. The cooling water situation in Western Eu rope is briefly reviewed. The above-mentioned cooling methods and attendant problems are thoroughly discussed for the Netherlands. Regarding future cooling water needs the available reserves in the Netherlands are estimated. Some possible beneficial effects of heated cooling water discharge are mentioned. Thermal discharges may keep waters ice-free which benefits navigation and acep waters ice-iree which benefits navigation and is biologically important for water birds. Rivers can be aerated in winter and the degradation period for phenols is prolonged. Heated water can also be used for fish farming and for agricultural applications. (See also W73-02768) (Oleszkiewicz-Vanderbilt) W73-02770

AIR POLLUTION FROM COMBUSTION PRODUCTS. Joint Labs. of the Electric Utilities in the Nether-

lands, Arnhem. A. J. Elshout, and H. Van Duuren.

A. J. Elshout, and H. Van Duuren.
In: Electrical Energy Needs and Environmental
Problems, Now and in the Future, Future Shape of
Technology Publication No. 7, Future Shape of
Technology Foundation, The Hague, Chapter 3, p
27-38, April 1971. 14 fig, 7 tab, 12 ref.

Descriptors: "Air pollution, "Thermal power-plants, "Pollutants, Sulfur compounds, Nitrogen compounds, Design, Dispersion. Identifiers: "Combustion products, Ground level concentrations, Dry adiabatic lapse rate, Ash, Stacks, Plumes, Emissions, Stack design.

The combustion of fossil fuels in power plants produces emission of sulphur oxides, nitrogen oxides, ash particles, carbon, unburned (partially oxidized) organic materials and inorganic trace gases. An evaluation of these air pollutants, their concentrations and their properties, is given. Present and future emissions and their relationship to the fuel pattern are discussed. Methods of controlling emissions are reviewed. Inertial separators (70-85% efficiency), wet collection devices (90-94% efficiency), and electrical precipitators (92-99.8% efficiency) can remove all but the smallest sub-micron particles of fly ash. Reduction of SO2 emission will increase total operational production costs by about 10%. Most methods for reducing NO emission except the two-stage combustion method result in a measurable loss of combustion method result in a measurable loss of combustion efficiency. Attention is given to the control of ground level concentrations of air pollutants. In this connection stack height, plume rise and meteorological factors are discussed. Finally research and development contributing to a better understanding and control of emission and dispersion of pollutants in the atmosphere are considered. (See also W73-02768) (Oleszkiewicz-Vanderbilt) derhilt) W73-02771

BIOLOGICAL EFFECTS OF COOLING WATER DISCHARGE, Rijksinstituut voor Zuivering van Afvalwater,

Nykinstituti voor Zaivering van Alvande, Voorburg (Netherlands).

J. L. Koolen.

In: Electrical Energy Needs and Environmental In: Decureal nergy Necessatus Environmental Problems, Now and in the Future, Future Shape of Technology Publication No. 7, Future Shape of Technology Foundation, The Hague, Chapter 4, p 39-49, April 1971. 5 fig. 3 tab, 6 ref.

Descriptors: *Temperature, *Water temperature, *Cooling water, Cooling, Cooling towers, Biochemistry, Fish, Velocity, Surface waters, Europe, Heated water, Thermal powerplants, Thermal pollution, Water quality standards, Hydraulics, Algicides. Identifiers: *The Netherlands *Riological effects

Three parameters are used to define water quality: the oxygen, the organic, biologically decomposa-ble matter, and the fertilizer salts contents of the water. The use of surface water, which contains a certain living biomass, as coolant, has an influence on the quality of the cooling water itself. The oxygen content may decrease and the content of organic, biologically decomposable material may increase, not least caused by the use of antifouling agents like chlorine. The discharge of used coolant to the receiving water has various consequences. In general, chemical and biochemical processes are accelerated. This is the main cause of all water quality and biological effects discussed. The maximum permissible temperature (30 C in the Netherlands) is mentioned, with respect to the uncertainty about this value. Some general recommenda-tions are: setting maximum permissible tempera-ture in the temperate areas at 30 C; quick mixing of the discharged coolant in the receiving water; no discharge of waste water in a cooling water system; avoidance of too large current velocities in the receiving water. (See also W73-02768) (Oleszkiewicz-Vanderbilt) W73-02772

BIOLOGICAL EFFECTS OF AIR POLLUTION, Instituut voor Gezondheidstechniek TNO, Delft,

(Netherlands).

(Nethertands).
P. E. Joosting, and J. C. ten Houten.
In: Electrical Energy Needs and Environmental
Problems, Now and in the Future, Future Shape of
Technology Publication No. 7, Future Shape of
Technology Foundation, The Hague, Chapter 5, p
51-38, April 1971. 6 fig. 11 ref.

Descriptors: "Air pollution, "Plants, "Animals, "Environmental effects, Sulfur compounds, Nitrogen compounds, Fossil fuels, Thermal powerplants, Powerplants, Standards. Identifiers: "Biological effects, Criteria.

Exposure of living organisms to sulphur dioxide. exposure of a rong organisms to supplie utokine, sulphuric acid, fly ash, other particulates, and ox-ides of nitrogen is discussed from the points of view of air pollution phenomenology, specific and nonspecific responses of plants, animals and man, nonspectific responses of paints, animals and man, and environmental and constitutional factors that influence the mode of response and the degree of effect. Some examples of dose/effect relationships are given. For sulphur dioxide and (black) suspended matter (as indices of pollution from the

Group 5C-Effects of Pollution

use of fossil fuels) both tolerable and unacceptable criteria are tentatively suggested for the purpose of planning and control. In addition argument is given - from the biological, physiological and common sense standpoints - in support of the concept of clean air conservation. (See also W73-02768) W73-02773

ENVIRONMENTAL EFFECTS SPECIFIC TO NUCLEAR POWER PRODUCTION, Reactor Centrum Nederland, Petten.

Reactor Centrum Nederland, Petten.

J. A. G. Davids, J. A. Goedkoop, and M. Muysken.

In: Electrical Engergy Needs and Environmental Problems, Now and in the Future, Future Shape of Technology Publication No. 7, Future Shape of Technology Foundation, The Hague, Netherlands, Chapter 6, p59-67, April 1971. 5 fig., 15 ref.

Descriptors: *Nuclear powerplants, *Radioactive Descriptors: "Auciear powerplants, "Andioactive wastes, Thermal powerplants, Air pollution, Water pollution, Radioactivity, Environmental ef-fects, Electric power, Economics, Hazards, Nuclear reactors, Nuclear energy, Storage, Stan-

Identifiers: *Waste heat, *Radiation safety stan-dards, Nuclear fuels, Fission products, Ionizing

The production of electric power from the fission of atomic nuclei is described as far as is necessary for an understanding of the environmental effects. Apart from the discharge of waste heat, common to all thermal power stations, these effects are all methods to the avecure of men to incining radiis. reducible to the exposure of man to ionizing radia-tion. There is broad international agreement on the safe limits for such exposure. It is shown that the radiation exposure from the normal operation of radiation exposure from the normal operation of muclear power stations can be kept well within these limits. The fission products, which might be released due to malfunction of the nuclear reactor, present a potential hazard, but this can be reduced to virtually zero at acceptable cost. The same applies to the further handling of these fission products during nuclear fuel reprocessing and permanent storage. (See also W73-02768) (Olesz-kiewicz-Vanderbilt) W73-02774

A COMPUTER PROGRAM FOR CALCULAT-ING NUTRIENT BALANCES,

New York State Dept. of Environmental Conservation, Albany, Environmental Quality Research and Development Unit.
For primary bibliographic entry see Field 07C.
W73-02858

SOURCES OF NUTRIENTS IN CANADARAGO

LAKE, New York State Dept. of Environmental Conservation, Albany. Environmental Quality Research and Development Unit. L. S. Hetling, and R. M. Sykes.

Technical Paper Number 3, Albany, March 1971. 35 p, 3 fig, 11 tab, 26 ref.

Descriptors: *Nutrients, *Eutrophication, *Water pollution sources, *New York, Water pollution control, Pollutant identification, Lakes. Identifiers: *Canadarago Lake (N.Y.), Nutrient

One of the most pressing problems in water quality management is the accelerating rate of eutrophica-tion of surface waters. The available data indicate that this acceleration is due to man's activities, although the exact relationship between man and the eutrophication process is not clear. To develop an effective control program, data for Canadarago an effective control program, data for Canadarago Lake in Ostego County, New York are needed. By setting up nutrient balances, gaging stream flows and nutrient concentrations, the net inputs to the 2-94 square mile lake were determined. Land use in the watershed is 50 percent agriculture, 35 per-

cent forest and 12 percent water. Only 3 percent of the land is used for urban developments, mining operations and miscellaneous uses. The net annual operations and miscellaneous uses. The net annual accumulations in hilograms are: phosphorus-1,360 and nitrogen-53,900 while chlorides magnesium and potassium accumulations were relatively minor. It is thought that a significant reduction in phosphorus input of about 66 percent could be achieved by reductions from livestock, lake cottages, and municipal sources. It is computed that 56 percent of the phosphorus in municipal sewage arises from detergents. Such reductions could, in 2 or 3 years, transfer the lake from an eutrophic system to a middly euthrophic system or system to a mildly euthrophic system mesotrophic system. (Poertner) W73-02859

PETROLEUM HYDROCARBONS AND THE

SEA, Washington State Dept. of Ecology, Olympia. Of-fice of Technical Services. E. DeNike.

October 1971. 20 p, 2 fig, 22 ref.

Descriptors: *Water pollution control, *Sea water, *Oil spills, Water pollution sources, Water pollu-tion effects, Fouling, *Toxicity, Water quality, Aquatic environment, *Environmental effects, Marine plants, Washington, Oil pollution, Surfac-

As more and more petroleum is transported by way of the oceans, marine oil spills become more and more common. Within the last few years, the effects of three oil spills on marine life have been documented. Sound long-range predictions of the effects oil may have on the marine ecosystem are hindered by the complex and variable nature and behavior of petroleum hydrocarbons, the intricate interrelationship and nossible admirts canneity of behavior of percent hydrocarbons, are instructed interrelationship and possible adaptive capacity of marine organisms, and the different geographical, meteorological and geological conditions at the site. Aromatics are the most toxic of the crude oil types while paraffins are the least dangerous and simplest types of crude oil. Although petroleum hydrocarbons might not injure certain com-ponents of the marine ecosystem directly, the effect of the oil spill on the food chain and marine habitat makes the oil spill's effect felt by the entire ecosystem. Plants are killed directly by the oil and birds are killed by lack of food and habitat and by oil coatings. Petroleum that cannot be removed physically after a spill at sea can be eliminated eventually by bio-oxidation. Because surface area of the hydrocarbon is an important factor controlling the rate of biodegradation, sur-factants are employed to reduce particle size; cer-tain types of surfactants, however, have demonstrated high toxicity to marine organisms. (Poertner) W73-02866

BIOASSAYS OF QUALITY IN WATER RESOURCES OF MAJOR IMPORTANCE TO

NEW MEXICO, New Mexico State Univ., University Park. Water Resources Research Inst. G. S. Smith.

Available from the National Technical Information Service as PB-213 628, \$3.00 in paper copy, 80.95 in microfiche. New Mexico Water Resources Research Institute, Las Cruces, Report No. 015, 1972, 82 p, 2 fig, 37 tab, 5 ref, append. OWRR A-022-NMEX (2).

Descriptors: "New Mexico, "Water quality,
"Animal physiology, "Small animals (Mammals),
"Water chemistry, Growth, Reproduction,
Domestic water, Laboratory animals, Rodents,
"Bioassay, Potable water.
Identifiers: "White mice (Mus musculus), "Drinking water quality, Chemical analysis, Mouse
growth, Water chemical characteristics, Growth
trials, Reproduction trials.

The objectives were to characterize some of the water resources of New Mexico in terms of quality for usage by ruminant and non-ruminant animals. to identify water resources with potential hazards to animal health, and to derive quantitative rela-tionships of animal performance. Fifty-two sam-ples from sources considered representative of some of the water resources that are economically and/or ecologically important to New Mexico were analyzed chemically for major minerals and assayed for quality in terms of mouse growth, mouse reproduction, and degradation of fibrous substrates by rumen microorganisms cultured in vitro. Using waters which varied in mineralization from less than 100 to more than 4700 milligrams of From less than 100 more man 7/00 more total dissolved solids per liter, mouse growth and reproduction were not significantly affected by water sources even though precision was sufficient to detect differences in growth of about 5 percent from the population means. The results in-dicate that the mouse is insensitive, in terms of growth and reproduction, to differences in quality of drinking water, at least in regard to the degree of gross mineralization; whereas, cultures of rumen microorganisms respond to changes in ap-parent quality of water. This suggests that certain parent quality of water. This suggests that certain major mineralized water resources of New Mexico may have greater potential for use in animal production than would be expected from standards of water quality currently used. (Creel-New Mexico State) W73-02876

ASSIMILATION OF A WASTEWATER TREAT-MENT PLANT EFFLUENT BY THE ASA CREEK-KASKASKIA RIVER SYSTEM, MOUL-TRIE COUNTY, ILLINOIS, Illinois Univ., Urbana. Dept. of Zoology.

A. R. Brigham.

Ph.D. Thesis, 1972. 93 p, 12 fig, 9 tab, 101 ref. OWRR A-040-ILL (1), 14-31-0001-3213.

Descriptors: Wastewater treatment, *Effluent,

*Periphyton, Treatment facilities, *Illinois, *Waste assimilative capacity.
Identifiers: Parameters, *Physico-chemical conditions, *Kaskaskia River (III).

Results of a coordinated physical, chemical, and biological study of 34 parameters measured biweekly at five stations in the Asa Creek-Kaskaskia River system, Moultrie County, IIlinois, revealed that wastewater treatment was of such high quality that the effluent was generally undetectable 2 km downstream from the outfall. Intrastation correlations among eight parameters measured during a periphyton accrual study at these stations revealed that the discharge of effluent into Asa Creek coupled with Asa Creek's low stream order resulted in not only a wide flux of physico-chemical conditions, but had a varied effect on the periphyton. Greater stability in the Kaskaskia River, a higher order stream, was reflected in more predictable levels of physico-chemical parameters and in more stable periphyton communities which developed there. Bacterial uptake kinetics experiments demonstrated that the periphyton at stations influenced by the wastewater treatment plant effluent assimilated two to three times more dissolved organic matter than at stations not influenced by the ef-fluent. The influence of the treatment plant was not as apparent for assimilation by planktonic bacteria. This reinforced the premise that the attached community was the most sensitive to subtle changes in the aquatic environment.

TOXICITY AND SPREADING OF OIL IN SEA

WATER, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02903

MULTI-DISCIP QUALITY REI Oregon Agricul

Sokuloski, and Oregon State U port 348, Febru ref, 3 append.W

Descriptors: * Fishing, *Recr put analysis, Water quality, I Identifiers: *P Water quality m dies, Yaquina B

The physical, b fects of pulp r Yaquina Bay ar Bay to sports fi fishery demand and clams. Giv mates of the co sports fisherme dicate the tot able to fish the level. The impa Bay economy i tionists were fo effect upon t \$317,000. Altern plicable to the The biological c pear to be of me are the dissolv Changes in the changes in the the fishery reset management in the-Wisconsin) W73-02921

CHANGES IN BULLHEAD (LESUEUR)) Fe TERM EXPOSI National Water G. M. Christens and E. P. Hunt. Toxicology and 417-427, 1972. 1

Aquatic enviro Water pollution eases, Fish plup

Blood from bro from 3.4 to 104 analyzed to ide blood cells, h chloride, plasm plasma glutami GOT), L-aspar ferase and plass cose and hemate the controls: af decreased, and cose increased; decreased. The having no detec head was determ (EPA abstract) W73-02947

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Effects of Pollution-Group 5C

MULTI-DISCIPLINARY STUDY OF WATER QUALITY RELATIONSHIPS: A CASE STUDY OF YAQUINA BAY, OREGON, Oregon Agricultural Experiment Station, Corval-

H. H. Stoevener, J. B. Stevens, H. F. Horton, A.

Sokuloski, and L. P. Parrish. Oregon State University Sea Grant, Special Report 348, February, 1972. 135 p, 6 fig, 30 tab, 63 ref, 3 append.WP-00107.

Descriptors: *Water pollution, *Pulp wastes, *Fishing, *Recreation demand, *Value, Input-out-

put analysis, Economic impact, Institutions, Water quality, Management, Regression analysis. Identifiers: "Pulp mill, "Consumers' surplus, Water quality management, Multi-disciplinary stu-dies, Yaquina Bay (Oregon).

The physical, biological, and socio-economics effects of pulp mill waste disposal into Oregon's Yaquina Bay are examined. The value of Yaquina Bay to sports fishermen is evaluated by estimating fishery demand equations for bottomfish, salmon, and clams. Given these demand functions, estimates of the consumers' surplus accruing to the sports fishermen can be obtained. These estimates indicate the total value fishermen place on being able to fish the bay, given its present pollution level. The impact of sports fishing on the Yaquina Bay economy is estimated with an input-output model. Annual expenditures of \$154,550 by recreationists were found to result in an overall output effect upon the economy of approximately \$317,000. Alternative waste disposal methods applicable to the pulp mill are analyzed, and their biological and economic consequences evaluated. The biological characteristics of the bay which appear to be of most significance for sports fisheries are the dissolved oxygen and toxicity levels. Changes in these parameters may bring about changes in the extent, vigor, and composition of the fishery resources, and thus indirectly affect the fisheries' value. The role of water quality management institutions is also considered. (Set-tle-Wisconsin)

CHANGES IN THE BLOOD OF THE BROWN BULLHEAD (ICTALURUS NEBULOSUS (LESUEUR)) FOLLOWING SHORT AND LONG TERM EXPOSURE TO COPPER (II), National Water Quality Lab., Duluth, Minn. G. M. Christensen, J. M. McKim, W. A. Brungs,

Toxicology and Applied Pharmacology, Vol 23, p 417-427, 1972. 1 fig. 4 tab, 34 ref.

Descriptors: *Toxicity, *Copper, *Bullheads, Aquatic environments, Environmental effects, Water pollution effects, Water quality, Fish dis-cases, Fish plupiology.

Blood from brown bullheads exposed to Cu (II) from 3.4 to 104 ug/1 for 6,30 and 600 days was analyzed to identify and evaluate changes in red blood cells, hematocrit, hemoglobin, plasma coloride, plasma total protein, plasma glucose, plasma glutamic osaloacetic transaminase (P-GOT), L-aspartate: 2-oxoglutarate aminotransferase and plasma lactic dehydrogenase (PLDH), L-lactate: NAD oxidoreductase. After 6 days, glucose and hematocrit increased significantly above the controls; after 30 days, chloride and protein decreased, and hematocrit, hemoglobin and glucose increased; after 600 days, the transaminase decreased. The maximum concentration of Cu (II) having no detectable effect upon the brown bullhead was determined to be between 11 and 16 ug/1. (EPA abstract)

TOXICITY OF ALUMINUM HYDROXIDE COMPLEXES IN NEUTRAL AND BASIC MEDIA TO RAINBOW TROUT, Colorado State Univ., Fort Collins, Dept. of Fishery and Wildlife Biology. Fishery and Wildlife Biology. R. A. Freeman, and W. H. Everhart. Transactions of the American Fisheries Society,

Vol 100, No 4, p 644-658, October 1971. 7 fig, 2

Descriptors: *Rainbow trout, *Toxicity, *Aluminum, Hydrogen ion concentration, Water pollu-tion effects, *Lethal limit.

Toxic effects of aqueous aluminum complexes in neutral and basic media to rainbow trout fingerlings were investigated under constantly flow-ing, controlled conditions of concentration, pH, and temperature. Toxicities of various concentra-tions were highly pH dependent. Dissolved con-centrations over 1.5 ppm aluminum caused drastic physiological and behavioral aberrations as well as acute mortality. Toxic effects of suspended alu-minum, while they are more noticeable at lower concentrations, are not as concentration dependent as those of dissolved forms. The safe con dent as those of dissolved forms. The safe concentration of either dissolved or suspended aluminum is well below 0.5 ppm. Mortalities among test animals ceased almost immediately after aluminum exposures were concluded. Recovery times for fish exposed to the various tests were proportional to the sevenity of the test conditions. and to the length of exposure. Normal growth resumed almost immediately in fish from the less severe tests, and after a period of a few weeks in fish from the more severe tests. After up to four months recovery the average weight of fish surviv-ing both chronically and acutely toxic aluminum concentrations is markedly below the control average. (See also W73-02950) (EPA abstract)

SOLUBILIZATION OF INORGANIC PHOSPHATE BY BACTERIA ISOLATED FROM UPPER KLAMATH LAKE SEDIMENT, Oregon State Microbiology. Univ., Corvallis. Dept.

M. J. Harrison, R. E. Pacha, and R. Y. Morita. Limnology and Oceanography, Vol 17, No 1, p 50-57, January 1972. 6 fig, 16 ref. EPA Program 16010

Descriptors: *Bacteria, Aquatic environments, Nutrients, *Phosphates, *Solubility, *Oregon, *Lake sediments.

Identifiers: *Upper Klamath Lake (Ore),
*Nutrient regeneration, *Phosphate solubilization,
Bacterial mineralization.

Bacteria that can solublize Fe PO4, Ca (PO4)2, CaFPO4, AI2 (PO4)2 and Mg2 (PO4)2 were iso-lated from the sediment of Upper Klamath Lake. Solublization was associated with carbohydrate metabolism and aerobic growth. Both car-bohydrates and products of algal lysis when added to the system stimulated solubilization of phosphates. Solubilization was attributed to the formation of organic acids that function as chelating agents, releasing free phosphate ions that can be utilized by algae. (Morita-EPA) W73-02954

FINE STRUCTURE OF SWARMERS OF CLADOPHORA AND CHARTOMORPHA. III. WALL SYNTHESIS AND DEVELOPMENT, WALL SIN HESIS AND DEVELOPMENT, Leeds Univ. (England). Dept. of Biophysics. D. G. Robinson, R. K. White, and R. D. Preston Planta (Berl.), Vol 107, No 2, p 131-144, 1972. 23

Descriptors: *Plant physiology, *Cytological studies, *Cladophora, *Algae, Walls, Synthesis, Descriptors: 'Frain physiology,' Cytological sides, *Cladophora, *Algae, Walls, Synthesis, Chlorophyta, Granules.

Identifiers: *Chaetomorpha, *Fine structure, Swarmers, Microfibrils, Glaucocystis nostochinearum, Oocystis apiculata. To determine how cellulose wall microfibrils are synthesized, total fine structure of a 'naked' plant cell, namely swarmers of Cladophora and Chaetomorpha, was studied. Two other green algae were also studied and Oocystis apiculata proved an admirable substitute for swarmers. Freeze-etch replicas with Oocystis have gone far toward substantiating involvement of plasmalemman granules in cellulose microfibril biosynthesis. The freezing procedure used with Oocystis, namely use of cardboard discs in place of copper and avoidance of cryoprotective agents, appeared a distinct advance; this technique was applied to Cladophora swarmers. Swarmers frozen after 9 hours liberation have lost their flagella, developed the characteristic fibrous layer, and show initial stages of wall production. Both the first formed and the later microfibrils seemingly linear arrays of granules may be seen. After 5 days settling a thick wall composed of almost transversely oriented microfibrils is present and a rhizoid is pushed out. Central localization of cell components and peripheral vacuolar distribution are characteristic of this stage. Longitudinally oriented microtubules absent during earlier wall formation reappear at this stage. Relationship between cortical microtubules of motile swarmers and development of fibrous layer is suggested. (Jones-Wisconsin) and development of fibrous layer is suggested. (Iones-Wisconsin) W73-02966

RELATIONS BETWEEN BIOMASS AND SPECIES DIVERSITY IN MARINE AND FRESH-WATER ZOOPLANKTON COMMUNITIES, Moscow State Univ. (USSR). Faculty of Biology and Soil Science.

A. M. Ghilarov, and A. G. Timonin. Oikos, Vol 23, No 2, p 190-196, 1972. 5 fig, 3 tab, 20 ref.

Descriptors: *Biomass, *Zooplankton, *Biological communities, Indian Ocean, Marine microorganisms, Aquatic microorganisms, Lakes, Mathematical studies, Herbivores, Copepods, Eutrophication, Dominant organisms.

Identifiers: *Species diversity, Kola Peninsula (USSR), Calanoida, Lapland National Park (USSR), Correlatiion coefficient.

Some perspectives on quantitative evaluation of Some perspectives on quantitative evaluation of the relation between biomass and species diversity are outlined. Availability of new convenient in-dices of diversity has enhanced interest in species diversity. Biomass and species diversity of zooplankton, collected in the northern Indian Ocean and in the Lapland National Park lakes (Kola Peninsula) were determined. Species diver tkoia reansuaia were determined. Species diver-sity was computed on the basis of biomass accord-ing to information theory. In the Indian Ocean material, herbivorous Calanoida were studied, since this group, richest in both species and in-dividuals, determines structure of the planktonic community, being the first connecting link between phyto- and zooplankton. Character of its changes corresponds most closely to changes in the whole community; negative correlation between biomass and species diversity was found. Meaning of correlation coefficient is higher for natural groups of samples than for totality of the data. In plankton samples from freshwater lakes. 150 km north of the Arctic Circle, a strong nega-130 km north of the Arctic Circle, a strong nega-tive correlation between biomass and diversity was also established when samples from some in-dividual lakes were analyzed, and simultaneously a weak positive correlation was found for the totality of all investigated lakes. Measurements of correlation between biomass and diversity may enable natural communities to be spatially delimited. (Jones-Wisconsin)

PERSISTING CIRCADIAN OSCILLATIONS IN ENZYME ACTIVITY IN NON-DIVIDING CUL-TURES OF EUGLENA, State Univ. of New York, Stony Brook. Div. of

Field 05-WATER QUALITY MANAGEMENT AND PROTECTION Group 5C-Effects of Pollution

F. M. Sulzman, and L. N. Edmunds, Jr. Biochemical and Biophysical Research Communi-cations, vol 47, No 6, p 1338-1344, 1972. 2 fig, 36

Descriptors: *Biorhythms, *Enzymes, *Euglena, *Cultures, Diurnal, Cycles, Biochemistry, Cultures, Diurnal, Cycles, Biochemistry, Cytological studies. Identifiers: Circadian oscillations, Alanine dehydrogenase, Euglena gracilis.

Circadian rhythms are present in all major classes of eucaryotic organisms from unicellular organ-isms to man, and reflect control processes at the temporal level of organization. The biochemical (hypothesized) basis of circadian rhythms and the temporal level of organization. The biochemical (hypothesized) basis of circadian rhythms and the mechanism by which these systems measure time with such accuracy is unknown. Activity of several enzymes (e.g. alaaine dehydrogenase) in Euglena gracilis in synchronously dividing cultures grown autotrophically in dium'alight cycles showed rhythmic fluctuations having a period of about 24 hours. Moreover, these oscillations occur in non-dividing, heterotrophically grown, stationary cultures and persist in darkness for 14 days. They are interpreted as representing biochemical 'hands' of an underlying, light-entrainable, endogenous, self-sustaining clock mechanism which can operate independently of the cell cycle. Results from inhibitor studies, mixing experiments, experiments utilizing different extraction techniques, and characterization of partially purified alanian dehydrogenase extracted from various points of oscillation suggest periodic synthesis and destruction of the enzyme generate the changes in its activity. Some interesting questions are raised concerning aging dynamics, stationary microorganism cultures, and possibility of intercellular chemical communication in a population of interacting cellular oscillators whose summated, synchronous output displays little, if any, states of the enzyme generate. Here there extend the extense of the enzyment mated, synchronous output displays little, if any, signs of decay over long time spans. (Jones-Wisconsin) W73-02969

DIEL PERIODICITY OF CHLOROPHYLL A CONCENTRATION IN OREGON COASTAL

Oregon State Univ., Corvallis. Dept. of Oceanography. W. A. Glooschenko, H. Curl, Jr., and L. F. Small. Journal Fisheries Research Board of Canada, Vol 29, No 9, p 1253-1259, 1972. 6 fig, 1 tab, 32 ref.

Descriptors: *Photoperiodism, *Photosynthesis, "Chlorophyll, "Coasts, "Oceans, "Lakes, Phytoplankton, Depth, Light intensity, Carbon, Plant physiology, "Oregon. Identifiers: "Chlorophyll a, Skeletonema costatum, Diel periodicity.

Diel periodicity of chlorophyll a concentration was studied in mixed phytoplankton assemblages in the field over different times of the year and with Skeletonema costatum in culture. Maximum surface concentrations often occurred around mid-night and highest 25-m concentration in early evening. Concentrations at intermediate depths fell in between and predictably with depth and time of day. Minimum chlorophyll a values oc-curred in the afternoon. Laboratory studies with curred in the afternoon. Laboratory studies with Skeletonema costatum demonstrated that diel cycle of chlorophyll a per cell was related to light intensity and duration of exposure. Highest concentrations occurred early in dark period and lowest concentrations in light periods when cells were grown under photoperiods of 9, 12, and 15 hours at intensity approximately 1200 ft-c. Under low light (400 ft-c) chlorophyll a synthesis occurred only in the light. This phenomenon was due to insufficient energy-yielding substrate or precursor synthesized during low-light period, and lack of bleaching in light period at that intensity. Laboratory results were consistent with field data. A correction for diel pigment periodicity is recom-A correction for diel pigment periodicity is recom-mended for models estimating photosynthesis from chlorophyll and light data and for oceanographic surveys where chlorophyll a is sampled throughout the 24-hour day. (Jones-Wisconsin) W73-02970

THE DETERMINATION OF PRIMARY PRODUCTION IN A STREAM USING AN EXACT SOLUTION TO THE OXYGEN BALANCE EQUATION, Virginia Univ., Charlotteville. Dept. of Environ-

Virginia Univ., Charlottevan.
mental Sciences.
G. M. Hornberger, and M. G. Kelly.
Water Resources Bulletin, American Water
Resources Association, Vol 8, No 4, p 795-801,

Descriptors: *Analytical techniques, *Primary productivity, "Streams, "Oxygen, Mathematical studies, Eutrophication, Dissolved oxygen, Respiration, Energy budget, Measurement. Identifiers: "Oxygen balance equation.

Although advanced stages of cultural eutrophication are easily recognized, methods allowing sim-ple recognition and quantification of its early pier recognition and quantification or its early stages are needed. An exact solution of the oxygen balance equation and two methods of calculation are presented to estimate primary production with an analysis of data by Owens. This allows evalua-tion of the approximate solutions which have been used previously in calculation of productivity. The effects of changing depth and oxygen saturation and the oxygen-productivity calculations are also evaluated. Use of the exact solution allows automated analysis of production and respiration from monitored streams and predictive simulation of ef-fects of changing flow, depth, etc., on the oxygen balance. A major advantage of this method is that continuous temporal variation of net production may be rigorously handled. The method is well may be rigorously handled. The method is well suited to the ultimate goal of studying energy budgets of streams, and thereby eutrophication. If proper data were available, effects of varying nutrient input, flow allochthonous respiratory load, and so on could similarly be determined. Ability of a stream to process additional organic load or its likelihood of producing excess photosynthate with increasing nutrient input could be predicted for varying conditions. (Jones-Wisconsin) W73-02971

EFFECTS OF STREPTOMYCIN ON THE UL-TRASTRUCTURE OF PLASTIDS IN EUGLENA, Tel-Aviv Univ. (Israel). Lab. for Electron

Microscopy. Y. Ben-Shaul, R. Silman, and I. Ophir. Physiologie Vegetale, Vol 10, No 2, p 255-268, 1972. 25 fig, 18 ref.

Descriptors: *Algae, *Structure, *Photosynthesis, *Euglena, Chlorophyll, Synthesis, Carbon dioxide, Cytological studies, Pigments. Identifiers: *Streptomycin, *Ultrastructure, *Plastids, Chloroplast development.

Changes in the physiological parameters of total chlorophyll formation, oxygen evolution, and car-bon dioxide fixation of Euglena cells treated with streptomycin are discussed. Plastids of dividing Euglena cells growing in the light in the presence of streptomycin lost their typical structure without following a regular pattern. The rate of chlorophyll tonowing a regular pattern. The rate of chorophylics and plating experiments indicated cessation of synthesis and a dilution among the progeny. The effect of streptomycin on the ultra-structural development of plastids in non-dividing cells was also investigated. The developmental pattern of plastids in both treated and untreated cells in identical up to 12-24 hours after illumination. From that period onwards untreated cells contained or-ganized chloroplasts, whereas, in treated cells, no further significant changes in ultrastructure with time were observed. In non-dividing cells exposed to light in the presence of streptomycin, the amount of chlorophyll accumulation was in correlation to structure development. The cells die not evolve oxygen or fix carbon dioxide and they lost very rapidly their ability to form green colo-nies when plated on streptomycin free medium. (Jones-Wisconsin) W73-02972

COMPILATION OF WATER QUALITY DATA AND PARAMETERS FROM KANSAS RIVERS AND STREAMS, Kansas State Univ., Manhattan. Inst. for Systems

Design and Optimization.
For primary bibliographic entry see Field 05A.

THE INTERACTION OF SEWAGE, THERMAL, AND ACID MINE WATER LOADINGS ON THE GROWTH OF CHLORELLA, West Virginia Univ., Morgantown

W. F. Skinner. MS thesis 1972. 182 p. 52 fig, 20 tab, 70 ref, 5 append. OWRR B-001-WVA (1).

Descriptors: Water pollution effects, *Sewage, *Thermal pollution, *Acid mine water, *Algae, *Chlorella, *Growth rates, Aquatic populations, Hydrogen ion concentration, Temperature, Statistical methods. Identifiers: Chlorella vulgaris.

Chlorella vulgaris population growth, as affected by sewage, thermal, and acid mine water loadings, was estimated by specific growth rate, population growth rate, generation time, length of time the population remains in lag phase of growth, and maximum algal population attained. Eleven temperature levels, four acid mine water concentra-tions, and two sewage levels were utilized in all combinations as environmental test conditions in which two replicate axenic cultures of Chlorella were grown. The data were statistically analyzed; all five growth statistics were significantly affected by temperature, while only generation time and lag phase were affected significantly by sewage and acid mine water. Interactions among the three experimental variables significantly afthe three experimental variaties significantly af-fected all of the growth statistics. During the 93 day experimental period, the temperature and sewage interaction produced significantly dif-ferent responses in the lag phase while tempera-ture and acid mine water interaction significantly affected maximum specific growth rate; the sewage and acid mine water interaction significantly affected responses in maximum growth attained, maximum population growth rate, and maximum specific growth rate, while the tempera-ture and sewage and acid mine water interaction significantly affected all the growth statistics except maximum specific growth rate. (Jones-Wisconsin) W73-02974

ANTIBODIES AGAINST HUMAN ENTERIC BACTERIA IN BROWN BULLHEADS (ICTALU-RUS NEBULOSUS, LESEUER) FROM CON-TAMINATED WATERS, West Virginia Univ., Morgantown.

J. L. Pupke.

MS thesis, 1972. 64 p. 4 fig, 14 tab, 32 ref, append. OWRR A-022-WVA (1).

Descriptors: *Human diseases, *Enteric bacteria, Besterptors: "Human mseases, "Enteric bacteria, Bullheads, Water pollution effects, Sewage, "Acid mine water, Fish, Pathogenic bacteria, Bacteria, Fish diseases, Septic tanks, E. coli, Coliforms, Vectors (Biological), "West Virginia. Identifiers: "Antibodies, Ictalurus nebulosis, "Monongahela River (W.V.a.), Klebsiella, Enterpheater, Mima, Agrangeas, budges, bid. terobacter, Mima, Aeromonas Aeromonas shigelloides. hydrophila,

Fish become infected by intimate contact with human enteric bacteria, as shown by their antibody production and can be vectors of human

diseases. Pres human enterio sociation of ar tal conditions cted as the and tolerance les for ch ing sewage e Monongahela drainage, and cluded a non terobacter, Kle teria-Aeromo higelloides. I ging from 0 were found. T ages of positiv sewage and a exists between tion and antib drainage, altho not significant fluctuating con W73-02975

> A C-14 ASSA AOUATIC PL Michigan State Botany and Pla R. A. Hough, a Plant Physiolo fig, 1 tab, 19 re

> Descriptors: Respiration. Carbon dioxid oxygen, Photo investigations. Identifiers: *P

trolling factors submersed pla well as in technique deve totally aqueou dioxide and labeled plants conditions. Ex enic cultures o water angiospe results indicat more oxygenhigh oxygen th torespiration response com restrial plants, was never app tion. Results in ilis suggest th lated to the ra from the plan water for disso W73-02978

ON THE PI FACTORY, Jyvaskyla Univ P. Eloranta. Annales Botar 1972. 12 fig, 29

Descriptors: Phytoplankto effects, Ecolo wastes, *Bion Hydrogen ic Diatoms, Chry ton, Eutrophic Identifiers: *K Volvocales.

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Effects of Pollution-Group 5C

diseases. Presence in fish of antibodies against human enteric bacteria was determined and as-sociation of antibody formation with environmen-tal conditions investigated in the brown builhead, selected as the test fish because of its food habits and tolerance to acid conditions. Fish and water samples for chemical and bacterial analyses were samples for chemical and bacterial analyses were made from four stations including two sites receiving sewage offluent on the acid-mine polluted Monongahela River, a lake receiving septic tank drainage, and an unpolluted pond. Antigens included a non-pathogenic Escherichia coli, Enterobacter, Klebsiella, Mima, and two aquatic bacteria-Aeromonas hydrophila and Aeromonas shigelloides. Large percentages of positive sera ranging from 0.6 for Klebsiella to 48.7% for E. coli was found The station with the greatest necessary. were found. The station with the greatest percentages of positives received the greatest volumes of sewage and acid-mine pollution. An association exists between type and amount of organic pollution and antibody production in fish. Acid-mine drainage, although reducing coliform densities, did not significantly affect antibody production when fluctuating conditions existed. (Jones-Wisconsin) W73-02975 were found. The station with the greatest percent-

A C-14 ASSAY FOR PHOTORESPIRATION IN AQUATIC PLANTS, Michigan State Univ., Hickory Corners. Dept. of

Botany and Plant Pathology.
R. A. Hough, and R. G. Wetzel.
Plant Physiology, Vol 49, No 6, p 987-990, 1972. 5 fig. 1 tab. 19 ref.

Descriptors: *Plant physiology, *Bioassay, *Respiration, *Aquatic plants, Submerged plants, Carbon dioxide, Analytical techniques, Dissolved oxygen, Photosynthesis, Light intensity, On-site investigations. Identifiers: *Photorespiration, Najas flexilis.

To determine the presence, magnitude, and con-To determine the presence, magnitude, and con-trolling factors of photorespiration in a variety of submersed plants relatively routinely, both in situ as well as in the laboratory, the basic C-14 technique developed by Zelitch was modified to a totally aqueous system in which release of carbon dioxide and organic carbon from previously labeled plants is followed over time under various conditions. Experiments were performed with ax-enic cultures of Najas flexilis, a submersed fresh-water angiosperm of the family Zosteraceae. The results indicated that respiration in the light was more oxygen-sensitive than that in the dark. The greater release of carbon dioxide in the light at high oxygen than at low oxygen suggests that photorespiration was induced. Contrary to the response commonly found in photorespiring terrestrial plants, however, photorespiration in Najas was never appreciably greater than dark respira-tion. Results in laboratory cultures of Najas flexilis suggest that photorespiration occurs but is limited in comparison to terrestrial plants and is related to the rate of diffusion of carbon dioxide from the plant and to the carrying capacity of water for dissolved oxygen. (Jones-Wisconsin) W73-02978

ON THE PHYTOPLANKTON OF WATERS POLLUTED BY A SULPHITE CELLULOSE

Jyvaskyla Univ. (Finland). Dept. of Biology. P. Eloranta.

Annales Botanici Fennici, Vol 9, No 1, p 20-28, 1972. 12 fig. 29 ref.

Descriptors: *Biological communities, *Phytoplankton, *Sulfite liquors, Water pollution effects, Ecological distribution, Cellulose, *Pulp wastes, *Biomass, Oxygen, Carbon dioxide, Hydrogen ion concentration, Cyanophyta, Diatoms, Chrysophyta, Euglenophyta, Zooplank-

ton, Eutrophication.
Identifiers: *Kokemaenjoki drainage basin, *Finland, Desmids, Chlorococcales, Tetrasporales,

Phytoplankton composition and biomass were studied in the lower Keuruu watercourse, tying in the Kokemaenjoki drainage basin of Finland, polluted by effluents of a sulphite cellulose and a paper fac-tory. Determinations were made of temperature, pH, and oxygen and free carbon dioxide contents of the water. Influence of the industrial effluents of the water. Influence of the industrial effluents varied greatly from one part of the area to the other, depending on the directions of the currents. Conditions in the study year were average compared with those of other years, and at the time of sampling, were favorable compared with those of the rest of the year, the influence of the effluents being clearly milder than average. The results being clearly milder than average. show that the factory effluents cause a strong decrease in the phytoplankton, in respect to both decrease in the phytopiankton, in respect to both the number of species and the biomass. On the other hand, eutrophication was clearly evident in the waters in which the influence of the effluents was slight and which also received nutrients from domestic sewage and the runoff from fields. The differences noted in the numbers of species and biomass of the zooplankton compared rather closely with the corresponding differences in the phytoplankton. (Jones-Wisconsin) W73-0297

ECOLOGY OF YELLOWSTONE THERMAL EF-FLUENT SYSTEMS: NET PRIMARY PRODUC. TION AND SPECIES DIVERSITY OF A SUC-CESSIONAL BLUE-GREEN ALGAL MAT. Georgia Univ., Athens. Dept. of Zoology.

P. C. Fraleigh.
Limnology and Oceanography, Vol 17, No 2, p
215-228, 1972. 7 fig, 5 tab, 36 ref.

Descriptors: *Thermal springs, *Primary productivity, *Cyanophyta, *Succession, Productivity, Carbon dioxide, Standing crops, Chlorophyll, Dissolved oxygen, Limiting factors, Thermal water, Streams, Algae, "Wyoming. Identifiers: "Yellowstone National Park, "Algal mats, Phormidium, Mastigociadus, Oscillatoria.

Blue-green algal mats develop in Yellowstone National Park hot spring effluents, maintaining constant standing crop as long as such environmental stant standing crop as long as such environmental conditions as water flow, pH, and temperature are unchanged. When the mat is destroyed, algae quickly recolonize and reach original steady-state value. Because of this rapid succession, the small size of these ecosystems, and their relative taxonomic simplicity, they are ideal for successional process study, which is documented and baseline data on net primary productivity provided. Linear increases in standing crop were observed during the first month of succession. An identical produc tivity pattern and mat increase was observed during August-September 1969. Measurements of particulate export in the second year indicated 22% of total net production may be lost via this pathway. Species diversity peaked after 2 weeks creased with distance from the source. Although 10 blue-green algal species were recognized, 3 made up most of the volume. Phormidium was dominant during first few days but declined as Mastigocladus increased. After 3 weeks Oscillatoria increased; its volume varied directly with distance from the source. A hypothesis naming free carbon dioxide as an important nutrient limiting mat growth rate is developed. (Jones-Wiscon-W73-02980

NEW DATA ON THE FAUNA OF NAIDIDAE (OLIGOCHAETA) OF LAKE BAIKAL, For primary bibliographic entry see Field 02H. W73-03016

WATER FOR TEXAS. Texas A and M Univ., College Station. Water Resources Inst. For primary bibliographic entry see Field 05B. W73-03066

THE IMPACT OF WATER DEVELOPMENT ON ECOLOGY OF THE GULF OF MEXICO, Texas A and M Univ., College Station. For primary bibliographic entry see Field 05B. W73-03070

SURFACE PHYTOPLANKTON AND SOME ASPECTS OF THE PHYSICAL-CHEMICAL LIMNOLOGY OF THREE AREAS ON LAKE

TEXOMA, Oklahoma Univ., Norman. Dept. of Zoology. For primary bibliographic entry see Field 02H. W73-03072

NATURAL REPODUCTION OF FISH IN THE VOLGOGRAD RESERVOIR (IN RUSSIAN), For primary bibliographic entry see Field 08I. W73-03102

DISTRIBUTION OF RED SPOT DISEASE IN WATERS USED FOR FISH BREEDING (IN RUS-SIAN). A. K. Shcherbina

Rybn Khoz Resp Mezhved Temat Nauchn Sb. 13.

p 84-86, 1971. Identifiers: Breeding, *Carp, *Disease (Fish), Distribution, Fish, *Red Spot disease, USSR.

Red spot disease of carp was first observed in the USSR in 1932. In 1954 the infection was present in 37 fish breeding projects with an area of about 8861 ha, 4 lakes and 5 reservoirs covering an area of 88,275 ha. Up to 1940 all 15 fish breeding establishments in the USSR were freed from the infection. When the western Ukrainian oblasts were annexed in 1940, 17 of 20 establishments were infected. By 1959 the number of unsatisfactory establishments in the Republic had risen to 23, or 59% of the total. This figure was decreased to 28% by 1969. Red spot disease was less severe in the Latvian, Moldavian, Uzbek and Kazakh SSR. By the beginning of 1970 the disease was eliminated in the Byelorussian and Kiriz SSR. The infection was not observed in bodies of water in the Azerbaidzhan, Armenian, Georgian, Turkmen or Estonian SSR. It has been eliminated in 117 fish breeding establishments, 6 lakes and reservoirs with a general area of 29,302 ha.--Copyright 1972, Biological Abstracts, Inc. W73-03109

DISTRIBUTION AND SEASONAL OCCUR-RENCE OF TABANIDAE ALONG A TRANSECT

Clemson Univ., S.C. Dept. of Entomology and Economic Zoology. For primary bibliographic entry see Field 05B. W73-03156

EFFLUENT AND WATER QUALITY CONTROL OF A SYNTHETIC FIBER PULP MILL (AB-WASSER UND GEWAESSERSCHUTZ EINER KUNSTFASERZELISTOFFABRIK),
For primary bibliographic entry see Field 05D. W73-03157

CHANGES IN THE PERIPHERAL BLOOD IN CARP (CYPRINUS CARPIO L.) UNDER THE IN-FLUENCE OF AMMONIUM LIQUOR (ZMIANY WE KRWI OBWODOWEJ KARPIS (CYPRINUS CARPIO L.) POD WPLYWEM WODY AMONIAKALNESJ, D. Wahuga, and J. Flis. Roczniki Nauk Rolniczych, Vol 93, No 2, p 87-94,

1971, 6 fig. 4 ref. English summary.

Descriptors: *Ammonia, *Poisons, *Fish diseases, Animal pathology, *Carp, *Toxicity, *Nitrogen compounds, Ammonium compounds, Lethal limit, Mortality, Pathology, Bioassay, Water pollution Identifiers: Blood, Anemia.

Group 5C-Effects of Pollution

The changes in peripheral blood among carp were investigated during poisoning with ammonium liquor. The established set of changes showed the symptoms of acute hemolytic anemia. It was accompanied by a reaction having the features of pathological degeneration. The decrease of leuko-cytes led to absolute peripheral leukopenia with a simultaneous intensive granulocytosis of a reac-tove character. (LeGore-Washington)

A SURVEY OF SOME POSSIBLE EFFECTS OF LOGGING ON TWO EASTERN VANCOUVER ISLAND STREAMS.

Fisheries Research Board of Canada, Nanaimo (British Columbia).

For primary bibliographic entry see Field 04C.

A SIMPLE TECHNIQUE FOR DETECTING EF-FECTS OF TOXICANTS OR OTHER STRESSES ON A PREDATOR-PREY INTERACTION. Savannah River Ecology Lab., Aiken, S.C.

C.P. Goodyear.

Transactions of the American Fisheries Society,
Vol 101, No 2, p 367-370, 1972. 3 fig, 3 ref. ABC

Descriptors: *Bioassay, Water pollution effects, *Predation, *Prey fish, *Mortality, Fish behavior, Analytical techniques, Bioindicators, Laboratory *Toxicity, Fishkill, Morbidity, Water pollution, Liverbearers, Forage fish, Bass. Identifiers: Secondary effects. *Secondary mortality, Indirect mortality.

Most investigation into the effects of aquatic pollutants has stressed the direct influence of stress, and has largely ignored secondary effects such as and has largely ignored secondary effects such as alteration of predator-prey relationships. A method of assessing the normal vs. impaired ability of mosquitofish (Gambusia affinis) to avoid predation by largemouth bass (Micropterus salmoides) is discussed. Compartmentalized dual cultures are used. An example in which mosquitofish were subjected to gamma irradiation is discussed. Suggestions for the technique's refinement are made. (LeGore-Washington) W73-03161

SOME ECOLOGICAL NOTES ON LOTIC DIP-TERAN EMERGENCE IN PRATER'S CREEK,

TERAN EMERGENCE IN PRATER'S CREEN, SOUTH CAROLINA, Clemson Univ., S.C. Dept. of Entomology and Economic Zoology.

W. K. Reisen, and R. C. Fox.
Annals of the Entomological Society of America, Vol 63, No 2, p 624-625, 1970. 1 tab, 15 ref. OWRR-A-013-SC (6).

Descriptors: *Diptera, *Aquatic insects, *Life history studies, Insects, Benthic fauna, Baseline stu-Animal behavior, Life cycles, *South Identifiers: Prater's Creek (S. C.).

The relationship between dipteran emergence times, daily and monthly, and imaginal drift in Prater's Creek, South Carolina was studied. Monthly variations in the number of drifting adults and larvae in numbers per meter (width of stream bottom over which the drift was measured) per 24 hr, benthic density in numbers per square meter, cumulative rainfall, water temperature, and dissolved oxygen are presented. Statistical evaluation of the data is discussed. Chironimidae and Simuliidae predominated in the specimen collections. (LeGore-Washington) W73-03162

AN APPROACH TO THE PROBLEM OF POL-LUTION AND FISHERIES, Department of the Environment Stevenage (En-

J. S. Alabaster, J. H. N. Garland, I. C. Hart, and J. F. de L. G. Solbe. Symposium of the Zoological Society of London, No 29, p 87-114, 1972, 9 fig, 4 tab, 32 ref.

Descriptors: Water pollution effects, "Analytical techniques, Water pollution, Water quality, Evaluation, Appraisals, Assessments, Forecasting, Theoretical analysis, "Toxicity, Environmental sanitation, "Lethal limit, "Trout, Water quality

Identifiers: *Water pollution evaluation, *Chronic effects. Acute effects, Water quality criteria.

Past work is reviewed to show that the short-term lethal effects of pollution on trout can be reasonably well defined from laboratory studies. The logical long-term approach would be to develop more elaborate laboratory experiments culminating in work on simulated polluted rivers and partially-controlled natural systems, but an alternative interim approach is described in which empirical relations are sought between short-term estimates of toxicity of fish and the presence or absence of fisheries in polluted rivers. The usefulness of this approach is illustrated by examples. Improvements and potential developments are suggested. (LeGore-Washington) W73-03163 Past work is reviewed to show that the short-term

EFFECTS OF HYDROGEN SULFIDE ON FISH

EGGS AND FRY, Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife. L. L. Smith, and D. M. Oseid.

Water Research, Vol 6, p 711-720, 1972. 3 fig, 6 tab. 4 ref.

Descriptors: Water pollution effects, *Hydrogen Descriptors: Water polution effects, "Flydrogen sulfide, "Toxicity, "Fish eggs, "Walleye, "Suckers, "Trout, "Pikes, Water quality, Lethal limit, Inorganic compounds, Sulfur compounds, Sulfur, Growth rates, Fish diseases, Bioassay, Dissolved oxygen, Resistance.

Identifiers: Growth inhibition, Abnormal develop-

Incubation of walleve, sucker, trout, and northern Incubation of walleye, sucker, trout, and northern pike eggs at levels of hydrogen sulfide often found in nature and in polluted situations has shown that these concentrations may be lethal, slow growth, extend incubation periods, and result in deformed fry under most conditions. Lowered oxygen tension increases the adverse effects of H2S. At extending the control of the control tremely low H2S concentrations (0.006 - 0.012 mg/1) growth may be stimulated without increased magij grown may be sumuated without increased mortality. In some cases survival over controls may be increased. Extended incubation periods coupled with decreased survival, smaller and deformed fry at levels exceeding 0.025 mg/l H2S strongly suggest that fish population maintenance is greatly inhibited where levels approach these concentrations during the incubation period and in zones where eggs or fry are found. With TL50
values for eggs at 4-10 days varying from 0.022 to
0.064 mg/1 under different conditions of 02 tension and temperature, and TL50 for walleye fry at 0.007 mg/1, it is assumed that a safe level will be below this minimum. Since a marked adverse effect is minimum. Since a marked salverse effect is noted on walleye eggs at 0.012 mg/1 at 12 C and 6 mg/1 of 02, and on fry at 0.007 mg/1, safe level will probably be less than 0.006 mg/1. (LeGore-Washington) W73-03164

ORGANOCHLORINE INSECTICIDE, HERBI-CIDE AND POLYCHLORINATED BIPHENYL (PCB) INHIBITION OF NAKATPASE IN RAIN-

Washington Univ., Seattle. School of Medicine.
P. W. Davis, J. M. Friedhoff, and G. A.

Wedemeyer.
Bulletin of Environmental Contamination and Toxicology, Vol 8, No 2, p 69-72, 1972. 1 tab, 10

Descriptors: "Pesticide toxicity, "Herbicides, "Insecticides, "Aroclors, "Polychlorinated biphenyls, "Chlorinated bydrocarbon pesticides, Fish physiology, "Inhibitors, "Enzymes, Toxicity, Fishkill, Fish diseases, Pesticide kinetics, 2-4-D, 2-4-5-T, DDD, DD DDT, Dieldrin, Endrin, Aldrin, Heptachlor, Organic pesticides, Metabolism, In-hibition, Biochemistry, Membranes, Lipids, Water pollution effects, Methodology, *Rainbow

Identifiers: Chlordane, Toxaphene, Strobane, Perthane, Methoxychlor, Lindane, Mirex, AT-Pase, NaK-ATPase, NaKMg-ATPase, Mg-AT-

Fourteen polychlorinated insecticides were tested for possible inhibition of trout gill ATPase: chlordane, heptachlor, DDD, aldrin, Toxaphene, DDT, strobane, DDE, perthane, methoxychlor, lindane, dieldrin, endrin, and mirex. Two PCB's, Aroclor 1242 and 1254, as well as two herbicides, 2,4-D and 1242 and 1254, as well as two herbicides, 2,4-D and 2,4,5-T, were similarly investigated. They were tested against NaKMg-ATPase, NaK-ATPase, and Mg-ATPase. Results implied that the lipid (membrane) solubility of these agents might be a factor in the magnitude of their inhibition of AT-Pase. In general, the insecticides were both more toxic and more effective ATPase inhibitors than were the PCB's, but the herbicides were least toxic and were the least effective inhibitors. (LeGore-Washington) W73-03165

THE INFLUENCE OF HERBICIDE 2,4-D-NA ON RESPIRATION AND SURVIVAL OF SIMOCEPHALUS VETULUS (O.F. MULLER) (CLADOCERA).

Polish Academy of Sciences, Warsaw.
R. Z. Klekowski, and J. Zvirgzds.
Polskie Archiwum Hydrobiologii, Vol 18, No 4, p 393-400, 1971. 2 fig, 1 tab, 9 ref.

Descriptors: *Herbicides, *2-4-D, *Crustaceans, Metabolism, Animal metabolism, Inhibitors, *Respiration, Resistance, Dissolved oxygen, *Oxygen requirements, Oxygen demand, Biochemical oxygen demand.

Identifiers: Survival (Fish), Simocephalus spp., Oxygen utilization.

The effect of a herbicide, 2,4-D-Na, on oxygen consumption by mature S. vetulus females was studied using a Cartesian diver technique. The metabolic rate was found to decrease but there was no linear dependence between oxygen consumption and herbicide concentration. These results were compared with those of survival, obtained in different herbicide concentrations and exposure times. Dramatic changes of metabolism were observed in herbicide concentrations higher than 5.0 mM, and of survival-in concentrations higher than 7.5 mM. (LeGore-Washington) W73-03166

METABOLISM OF DIAZINON BY FISH LIVER

MICROSOMES, Bureau of Sport Fisheries and Wildlife, Columbia,

Mo. Fish-Pesticide Research Lab.
J. W. Hogan, and C. O. Knowles.
Bulletin of Environmental Contamination and
Toxicology, Vol 8, No 1, p 61-64, 1972. 3 tab, 9 ref.

Descriptors: *Inhibitors, Fish physiology, *Organophosphorous pesticides, Enzymes Biochemistry, *Metabolism, Animal metabolism, *Pesticide toxicity, Pesticide kinetics, Mode of action, Water pollution effects.
Identifiers: *Diazinon, Diazoxon, *Fish liver.

Experiments indicate that the in vitro metabolism of diazinon is accomplished by enzyme prepara-tions from fish liver homogenates, with the tions from the more more active. The en-zyme system responsible for diazinon metabolism in channel catfish liver microsomes required NADPH and oxygen for the oxidative desulfura-

tion of diazino cleavage of d respectively. T to be catalyzed (sub 450) mixed slight increase catfish hepatic with exogenous dent enzymes Washington) W73-03167

CULTURE, RE TURE TOLER FINIS IN THE National Water W. E. Smith. sactions of Vol 101, No 2, p

Descriptors: *A tion, *Therm Crustaceans, W Water temperate Identifiers: *Pe requirements, C culture, Subs tolerance.

A population of was maintained months, during cessfully. They strate into whi marked circulati adverse effect u egg yolk prepara leaf powder was Temperature to TLm of 12 C, a 9 TLm of 10.4 C. () W73-03168

EFFECTS OF L OF ANAESTHE -222 ON THE MON (SALMO TAL FLUCTUA DIOXIDE TENS Uppsala Univ., (L. B. Hoglund, a Institute of Fres Sweden, Report 15 ref. NSNCO 7

scriptors: *Hydrogen ion Salmonids, Bio Water chemistry Identifiers: P Mathanesulfonat

Atlantic salmon restrained by ar those permitted variations in pH levels. The maxir period was higher swim. The impor-variations in the a sumed difference CO2 with the d discussed. The disturbances industrial response tests. (L W73-03169

ACIDITY AND BLOOD OF Y (SALMO SALAR Uppsala Univ. (S L. B. Hoglund, an

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

tion of diazinon to diazoxon, and probably for cleavage of diazinon and diazoxon to diethyl phosphorothioic acid and diethyl phosphoric acid. respectively. Thus, these reactions are presumed to be catalyzed by the NADPH- cytochrome P (sub 450) mixed function oxidase system. The only slight increase in diazinon metabolism by channel sugnt increase in diazinon metabolism by channel catfish hepatic microsomal or soluble enzymes with exogenous GSH suggests that GSH-depen-dent enzymes were not very active. (LeGore-Washington) W73-03167

CULTURE, REPRODUCTION, AND TEMPERA-TURE TOLERANCE OF PONTOPOREIA AF-FINIS IN THE LABORATORY, National Water Quality Lab., Duluth, Minn.

W E Smith.

Transactions of the American Fisheries Society, Vol 101, No 2, p 253-256, 1972. 2 fig, 2 tab, 6 ref.

Descriptors: *Amphipoda, *Cultures, *Reproduction, *Thermal stress, Aquatic animals, Crustaceans, Water requirements, Temperature,

Valer temperature.

Identifiers: *Pontoporeia affinis, Temperature requirements, Cultueal requirements, Laboratory culture,

Substrate requirements, *Thermal tolerance.

A population of amphipods, Pontoporeia affinis, was maintained in the laboratory at 6 C for over 3 months, during which the animals reproduced sucmontans, during which the animals reproduced suc-cessfully. They appeared to require a silty sub-strate into which they could burrow, and any marked circulation or agitation of the water had an adverse effect upon them. A mixture of powdered egg yolk preparation and dehydrated cereal grass leaf powder was the most successful food source. Temperature tolerance tests resulted in a 24 hr TLm of 12 C, a 96 hr TLm of 10.8 C, and a 30 days TLm of 10.4 C. (LeGore-Washington)

EFFECTS OF LOCOMOTER RESTRAINT AND OF ANAESTHESIA WITH URETHANE OR MS--222 ON THE REACTIONS OF YOUNG SAL-MON (SALMO SALAHRL.) TO ENVIRONMEN-TAL FLUCTUATIONS OF PH AND CARBON DIOXIDE TENSION, Uppsala Univ., (Sweden).

Oppsian Ontv., (Sweden). L. B. Hoglund, and A. Persson. Institute of Freshwater Research, Drottningholm, Sweden, Report No 51, p 75-89, 1971. 5 fig, 4 tab, 15 ref. NSNCO 7-41/68, 3433-7-68.

Descriptors: *Salmon. *Atlantic Hydrogen ion concentration, "Atlantic salmon, "Hydrogen ion concentration, 'Carbon dioxide, Salmonids, Bioassay, Bioindicators, Acidity, Water chemistry, Fish physiology, Fish behavior. Identifiers: Parr, "Anesthesia, MS-222, Mathanesulfonate, Anoxia.

Atlantic salmon parr whose movements were restrained by anaesthesia were compared with those permitted to move freely when exposed to variations in pH (6.8-7.5) and pC O2 (5-30 mm Hg) levels. The maximum ventilation during a CO2 test period was higher in a fish that was allowed to swim. The importance for the ventilation rate of variations in the ambient CO2 tension and of an assumed difference in accumulation of endogenous CO2 with the different types of movements is discussed. The degree and duration of reflex disturbances induced by urethane or MS-222 were studied in unrestrained fish by repeated CO2-response tests. (LeGore-Washington) W73-03169

ACIDITY AND LACTATE CONTENT IN THE BLOOD OF YOUNG ATLANTIC SALMON (SALMO SALAR L.) EXPOSED TO HIGH PCO2, Uppsala Univ. (Sweden).
L. B. Hoglund, and H. Borjeson.

Institute of Freshwater Research, Drottningholm Sweden, Report No 51, p 67-74, 1971. 1 fig, 2 tab, 21 ref. NSNCO 7-41/68, 3433-7-68.

Descriptors: "Salmon, "Atlantic salmon, "Hydrogen ion concentration, "Carbon dioxide, "Acid-base equilibrium, Salmonids, Bioassay, Acidity, Fish physiology, Fish diseases. Identifiers: Parr, Anoxia, "Lactate, Blood chemistry, Fish blood, Acidost

The transitory changes of pH and lactate content in the blood of young salmon (Salmo salar) in response to raised pCO2 in the ambient water were investigated. An effective acid-base regulation was found to counteract a pronounced acidosis induced by a sudden rise of pCO2 in the ambient water. The acidosis is not correlated to any significant changes of blood lactate. (LeGore - Washington) ton) W73-03170

EFFECTS OF AN ARTIFICIAL STREAM ON MARINE COMMUNITIES, Centre d'Oceanographie, Marseille (France). Sta-tion Marine d'Endoume.

Marine Pollution Bulletin, Vol 3, No 5, p 74-77, May 1972. 3 fig. 7 ref.

Descriptors: *Impaired water quality, *Canal design, Canals, *Channels, Water quality, Water pollution sources, *Alteration of flow, Brackish water, Water types, Aquatic animals, Aquatic life, Saline water fish, Estuarine fisheries, Canal con-struction, Open channels, Bodies of water, Encroachment, Water pollution effects, Water quali-ty control. Streamflow.

Identifiers: *France, Salinity alteration, Freshwater intrustion, Estuarine alteration, *Marseilles.

A brackish lagoon near Marseilles now receives an erratic inflow of fresh water. The fauna and flora were studied before and after the construction of a canal which introduces the fresh water. Instead of the expected change from a marine dominated to a brackish biota, a general impoverishment has resulted. Increasing urbanization and industrializa-tion of the area is causing extensive deterioration of the coastal environment of which this lagoon forms a part. (LeGore-Washington)
W73-03171

NUMBER OF COMMERCIAL FISH IN THE VOLGOGRAD RESERVOIR AND MEASURES FOR INCREASING THEIR PRODUCTIVITY, (IN RUSSIAN),
For primary bibliographic entry see Field 08I.
W73-03172

THE USE OF A MULTI-CELLED APPARATUS FOR ANAEROBIC STUDIES OF FLOODED ROOT SYSTEMS,

Agricultural Research and Educational Center, Lake Alfred, Fla.
For primary bibliographic entry see Field 02I.
W73-03194

THE POISON CHAIN FOR MERCURY IN THE ENVIRONMENT, Middlesex Hospital Medical School, London (England). For primary bibliographic entry see Field 05B. W73-03202

ENVIRONMENTAL MONITORING SOCIATED WITH DISCHARGES OF RADIOAC-TIVE WASTE DURING 1969 FROM UKAEA ESTABLISHMENTS.

United Kingdom Atomic Energy Authority, Har-well (England). Authority Health and Safety For primary bibliographic entry see Field 05B.

W73-03220

5D. Waste Treatment Processes

PUBLIC ATTITUDES TOWARD REUSE OF RECLAIMED WATER, California Univ., Berkeley. Water Resources

Center.
W. H. Bruvold.
Available from the National Technical Information Service as PB-213 455, \$3.00 in paper copy, 80.95 in microfiche. California Water Resources Center, Los Angeles, Contribution No 137, 1972.
60 p. 15 tab, 16 ref. 2 append. OWRRC-2015 (H3335) (I) and A-030-CAL (I). 14-31-0001-3355.

Descriptors: *Reclaimed water, *Attitudes, *Behavior, *California, Recreation facilities, Desalination, Demineralization, Imported water, Public rights, Domestic water, Beneficial use, *Water reuse. Identifiers: *Public attitudes.

Survey research was conducted in ten California communities to assess behavior toward recreational facilisties supplied with reclaimed water, to gauge beliefs and knowledge concerning California's water resources, to measure attitudes toward various possible uses of reclaimed water, and to record basic demographic data on the respondents participating. Approximately 100 respondents were interviewed in each town studied. Results obtained showed low to moderate usage of existing tained showed low to moderate usage of existing reclamation facilities with nonuse due to factors other than the character of the water supply. Most respondents were not convinced that California respondents were not convinced that California needed new water supply at the present time and most were unsure about the character of four possible new sources of supply: desalinized, demineralized ground, reclaimed waste, and imported surface, water. Respondent consideration of 25 possible uses of reclaimed water yielded opposition by more than 50 percent of the sample to the four highest contact uses. Eleven lower contact uses were opposed by less than 10 percent of the respondents. Educational level and beliefs about scientific water purification methods were the variables most highly related to attitudes toward reclaimed water with lesser associations between attitude and north-south location in the State, usage of recreation facilities, and belief State, usage of recreation facilities, and belief about need for new water in California today. The major recommendation of the study was for in novative use of reclaimed water to begin with low contact purposes highly visible to the public. W73-02601

PHYSICO-CHEMICAL LIMNOLOGY AND PERIPHYTON IN A WARM-WATER STREAM RECEIVING WASTEWATER TREATMENT PLANT EFFLUENT,

Illinois Univ., Urbana. Water Resources Center.

Illinois Univ., Urbana. Water Resources Center.
A. R. Brigham, and R. W. Larimore.
Available from the National Technical Information Service as PB-213 501, 33.00 in paper copy, \$0.95 in microfiche. Research Report No 59, September 1972. 83, 12 fig., 7 tab, 101 ref. OWRR A-040-ILL (2), 14-31-0001-3213.

Descriptors: Water pollution effects, "Physicochemical properties, Water pollution sources, Waste water treatment, "Effuent, Periphyton, Treatment facilities, "Illinois, "Waste water disposal, Limology, Organic matter. Identifiers: "Asa Creek-Kaskaskia River (III).

Results of a coordinated physical, chemical, and biological study of 34 parameters measured biweekly at five stations in the Asa Creek-kaskaskia River system, Moultrie County, Ilois, revealed that wastewater treatment was of such high quality that the effluent was generally undetectable 2 km downstream from the outfall. Intrastation correlations among eight parameters measured during a periphyton accrual study at

Group 5D—Waste Treatment Processes

these stations revealed that the discharge of effluent into Asa Creek coupled with Asa Creek's low stream order resulted in not only a wide flux of physico-chemical conditions, but had a varied of physico-chemical conditions, but nat a varied effect on the periphyton. Greater stability in the Kaskaskia River, a higher order stream, was reflected in more predictable levels of physico-chemical parameters and in more stable periphyton communities which developed there. Bacterial uptake kinetics experiments demonstrated the property of the pr strated that the periphyton at stations influenced by the wastewater treatment plant effluent assimilated two to three times more dissolved organic matter than at stations not influenced by the ef-fluent. The influence of the treatment plant was not as apparent for assimilation by planktonic bacteria. This reinforced the premise that the attached community was the most sensitive to subtle changes in the aquatic environment.

W73-02603

A NEW APPROACH FOR WATER RECLAMA-TION - COMPLETE TREATMENT OF WASTE WATER BY PHYSICO-CHEMICAL WATER

Missouri Water Resources Research Center, Rol-

J. C. Huang, M. G. Hardie, K. A. Narasimhan, C. S. Lu, and L. T. Chiang.

Available from the National Technical Informa-

Available from the National Technical Informa-tion Service as PB-213 504, \$3.00 in paper copy, \$0.95 in microfiche. Missouri Water Resources Research Center, Columbia, Completion Report, August 1972, 26 p. 5 fig. 2 tab, 7 ref. OWRR A-037-MO (1). 14-31-0001-3225-3525.

Descriptors: Chemical wastes, *Waste water treatment, Water pollution control, Carbon, *Adsorption, *Coagulation, Physical-chemical treatment, *Industrial wastes. Identifiers: Refinery waste, Pharmaceutical waste.

The technical applicability as well as the effectiveness of physical-chemical processes for the treat-ment of three kinds of industrial wastewater were evaluated. The wastewaters included a refinery waste, a high-strength acidic chemical waste, and a pharmaceutical waste. The general physicalchemical treatment scheme consisted of chemical coagulation, clarification, and carbon adsorption. Chemical coagulation with metal salts was effective in the removal of suspended solids from both the refinery and the pharmaceutical waste streams. Good removals of phosphorus were also achieved through coagulation and clarification. The extent of organic removal by carbon adsorp-tion varied not only from one industrial waste to another, but also from one kind of carbon to another for a particular waste. The alkaline hydrol-ysis principle of 'Z-M Process' was not applicable to the three industrial wastes studied. Therefore, it is felt that before the Z-M Process is incorporated into a physical-chemical treatment scheme, a careful evaluation of the process performance on the particular waste should be conducted.
W73-02607

THE PREPARATION AND OXIDATIVE PRO-PERTIES OF FERRATE ION (FE042-). STU-DIES DIRECTED TOWARD ITS USE AS A WATER PURIFYING AGENT,

Missouri Water Resources Research Center, Columbia.

For primary bibliographic entry see Field 05F. W73-02608

OPTIMAL CONDITIONING PROCEDURES FOR WASTE ACTIVATED SLUDGE DISPOSAL, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. C. W. Randall.

Available from the National Technical Informa-tion Service as PB-213 494, \$3.00 in paper copy, \$0.95 in microfiche. Virginia Water Resources

Research Center Completion Report, August 1972, 37 p, 4 fig. OWRR A-035-VA (7).

Descriptors: *Activated aludge, Sludge digestion, *Sludge treatment, Dewatering, Filtration, Polymers, Aerobic treatment, Digestion, *Sludge disposal, *Waste water treatment. Identifiers: Aerobic digestion, Activated sludge

Waste activated sludge from three full-scale wastewater treatment plants was subjected to laboratory-scale sludge handling and dewatering procedures in a series of experiments designed to procedures in a series of experiments oesigned to evaluate the effect of commonly used techniques on dewater-ability and to define the mechanisms responsible for changes in dewaterability. The results showed that the techniques used to handle waste activated sludge can have a drastic effect on the subsequent rate of dewatering. For optimum dewatering, the sludge organisms must be maintained in a viable, aerobic condition and metabolic tanted in a value, aerotic condition and metabonic activity must occur. Aerobic digestion can produce significant improvements in dewatering rates. The conditioning effects of synthetic polymers are also strongly affected by handling techniques. Changes in the median particle size of the sludge floc strongly affects specific resistance and the compressibility factor.

W73-02616 W73-02616

ANAEROBIC TREATMENT OF STARCH WASTEWATERS,
Delaware Univ., Newark. Dept. of Civil Engineer-

G. P. Rasmussen.

Available from the National Technical Information Service as PB-213 465, \$3.00 in paper copy, \$0.95 in microfiche. Delaware Water Resources Center Research Project Technical Completion Report, June 1972. 4 p. OWRR A-011-DEL (1).

Descriptors: *Anaerobic digestion, *Waste water reatment, "Industrial wastes, Waste water, Absorption, "Flotation, Coagulation, Food processing industry, Rice, "Chemical oxygen de-Identifiers: *Rice process waste water.

Treatability studies of pre-prepared rice process wastewater demonstrated that COD removals of 92 percent can be obtained by high rate anaerobic digestion having a solids retention time of less than 4 days. Optimum temperature for the digestion process was 42C. Biological solids-wastewater process was 42C. Biological solids-wastewater mixing tests showed that up to 95 percent of the soluble wastewater COD is taken up by biological solids at a COD/VSS ratio of 0.4. Attempts to separate the resulting mixed-liquor solids from the wastewater stream by plain and chemically aided sedimentation proved unattractive due to the slow formation and settling velocity of the solids interface and the low solids concentration of the unserface and the solid derflow stream. Batch-test dissolved-air flotation of the mixed liquor solids resulted in a total contact-flotation system COD removal of only 80 percent. W73-02619

CHEMICAL AND PHYSICAL FACTORS IN THE FLOCCULATION OF METAL PLATING WASTES WITH POLYELECTROLYTES. Rhode Island Univ., Kingston. Water Resources

Available from the National Technical Informa-tion Service as PB-213 460, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, 1972. 16 p, 5 fig. 4 tab, 5 ref. OWRR A-037-RI (1). 14-31-0001-3240.

Descriptors: *Waste water treatment, *Floccula-tion. *Polyelectrolytes, Sludge, *Industrial tion, *Polyelectrolytes, Sludge, *Industrial wastes, Chemical wastes, Turbidity, Particle size. Identifiers: *Metal plating wastes, Sludge resistivi-

Studies are described on the flocculation of metal plating wastes with cationic, anionic, and nonionic polyelectrolytes. Model wastes were prepared with Cr2O7±, Ni+2, Cu+2, and clay as a source with CF2O/x, Ni+2, Cu+2, and cisy as a source of turbidity. Actual waste samples also were used. These were taken as untreated effluents from metal plating and finishing plants. The efficiency of the treatment of these wastes with polyelectrolytes was defined in terms of the flocculation kinetics. The parameters of interest were the initial kinetics. The parameters of interest were the initial decrease in turbidity, dr/dt and the turbidity after I hour. Other parameters that were evaluated in order to follow the flocculation process were the final particle size and the settled studge resistivity to flow. The treatment of metal plating wastes by polyelectrolyte flocculation is compared to the treatment by reduction and precipitation methods. W73-02626

DESALTING AS A SOURCE OF WATER

SUPPLY, Office of Saline Water, Washington, D.C. For primary bibliographic entry see Field 03A. W73-02861

'APOLLO COUNTY PARK', WASTE WATER RECLAMATION PROJECT FOR THE ANTELOPE VALLEY AREA, LOS ANGELES COUNTY. Los Angeles Dept. of County Engineer, Downey, Calif. Sanitation Div.

October 1971, 10 p. 7 fig.

Descriptors: Waste water disposal, *California, Sewage treatment, Municipal wastes, Effluents, *Tertiary treatment, Water pollution control, *Waste water treatment, *Water resue, *Land reclamation, Oxidation lagoons.

Identifiers: *Antelope Valley, *Los Angeles

The Antelope Valley in Los Angeles County has an annual rainfall of only 2 to 3 inches. In an effort to provide recreational activities, soil reclamation and conserve water, a four year study program was undertaken in 1964. The results were so encouraging that the full scale project was developed. A 0.5 mgd capacity tertiary plant costing \$240,000 was built to provide renovated waste water for the Apollo County Park and a soil recla-mation program. The influent is from the oxidation ponds on the area's secondary plant which was ponds on the area's secondary plant which was built in 1959 at a operating size of 13.6 mgd of which 3 mgd is presently being used. Tertiary treatment follows a 60-day detention period in the oxidation ponds and includes the following: coagu-lation, sedimentation, filtration through a dual-media anthracite sand filter, and chlorination. Skimmings and sludge from the tertiary treatment are returned to the primary treatment plant. Final are returned to the primary treatment plant. Final effluent standards have been very good; for example, coliform counts have dropped from 150,000 MPN/100 ml in the oxidation pond effleunt to zero in the final effluent. The tertiary plant effluent is judged suitable for sport fishing and boating. The final effluent is also being used to convert some of the largely barren desert land in the Antelope Valley into productive land with plantings of trees, shrubs, and grass. (Poertner) W73-02867

MASS TRANSFER AND CHEMICAL REAC-TION IN TWO-PHASE FLOW, Delaware Univ., Newark. Dept. of Chemical En-

gineering. T. W. F. Russell.

Available from the National Technical Informa-tion Service as PB-213 627, \$3.00 in paper copy, \$0.95 in microfiche. Delaware Water Resourcet Center Research Project Technical Completion Report, August 28, 1972. 19 p, 2 fig, 7 ref. OWRR-A-008-DEL (1).

Descriptors: M matical models treatment, *Pip

A mathematics transfer and re tors is develop detail for eva design procedu of treating sew and it is shown pipelines is tec W73-02875

THE EFFECT DIGESTION, Virginia Poly Blacksburg. De C. W. Randail, Presented at F Conference, Penn., Nov 17 OWRR A-035-

Descriptors: *Abic conditions, watering, Slud Identifiers: *A

Both laborato digesters were aerobic digestic the supernatan subsequent slu tained from sev were studied d to digester uni vary normally, pH values of 3 of experiments solids destruc small. Substan levels includin range was con destruction du stronger functi liquor during a on the level of pernatant. Ho can exist at lo significant imp waterability. (S ginia Tech) W73-02897

IMMEDIATE OF WATER PO Naval Postgrad For primary bib W73-02901

SHIPBOARD C **Naval Postgrad** For primary bit W73-02902

CHARACTERI BILGE AND B Naval Postgrad For primary bit W73-02905

POLLUTION: Stockholm Uni P. Bohm. Kyklos, Vol 25.

Descriptors: 4 taxes (Charges timization, Inve

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Waste Treatment Processes—Group 5D

Descriptors: Mass transfer, Oxygenation, *Mathematical models, Waste water treatment, *Sewage treatment, *Pipelines, Design.

A mathematical description of the process of mass transfer and reaction in gas-liquid pipeline contactors is developed and procedures are outlined in detail for evaluating the model parameters. A design procedure is developed for the special case of treating sewage in enclosed pressure pipelines, and it is shown that secondary sewage treatment in pipelines is technically feasible.

W73-02875

THE EFFECT OF PH ON AEROBIC SLUDGE

THE EFFECT OF PR ON AEROBIC SLIDGE DIGESTION, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. C. W. Randall, H. R. Moore, and P. H. King. Presented at Fifth Mid-Atlantic Industrial Waste Conference, Drexel University, Philadelphia, Penn., Nov 17-9, 1971. 27 p., 11 fig. 2 tab, 8 ref. OWRR A-075-VA (4).

Descriptors: *Activated sludge, *Digestion, Aerobic conditions, *Hydrogen ion concentration, Dewatering, Sludge treatment, *Waste water treat-

ment. Identifiers: *Aerobic digestion.

Both laboratory and pilot-plant scale aerobic digesters were used to study pH changes during aerobic digestion, the effects of the pH changes on the supernatant and sludge properties, and the effect of controlled pH on the digestion process and subsequent sludge dewatering. Nine sludges, obtained from seven different waste treatment plants tained from seven different waste treatment plants were studied during the investigations. In addition to digester units where the pH was permitted to vary normally, units were maintained at constant pH values of 3.5, 4.5, 5.0, 7.0, and 9.5. The series of experiments showed that the effect of pH on solids destruction during aerobic digestion is small. Substantial destruction occurred at pH levels including 3.5 and 9.5. The optimum pH range was concluded to be from 6 to 7. Sludge destruction during aerobic digestion is a much stronger function of the initial volatile solidis fraction in the activated sludge. The pH of the mixed to the stronger function of the single photon of the photon of the photon of the single tion in the activated sludge. The pH of the mixed liquor during aerobic digestion has a strong effect on the level of nitrates and phosphates in the suon the level of intrates and phosphates in the su-pernatant. However, large protozoa population can exist at low pH's and they can produce very significant improvements in activated sludge de-waterability. (See also W72-04051) (Johnson-Virginia Tech) W73-02897

IMMEDIATE COST-EFFECTIVE ABATEMENT OF WATER POLLUTION FROM NAVY SHIPS. Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02901

SHIPBOARD CONTROL OF WASTES, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02902

CHARACTERIZATION AND TREATMENT OF BILGE AND BALLAST WATER, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02905

POLLUTION: TAXATION OR PURIFICATION. Stockholm Univ. (Sweden). P. Bohm.

Kyklos, Vol 25, Fasc 3, p 501-517, 1972. 8 fig.

Descriptors: *Pollution abatement, *Pollution taxes (Charges), *Waste water treatment, Optimization, Investment, Mathematical models.

Identifiers: *Externalities, Policy, Production.

The problem of optimal choice between effluent taxation and centralized waste treatment is considered. The analysis is developed with a model of two firms in an otherwise perfect market economy. Both firms are regarded as perfectly competitive producers and resource users in their respective producers and resource users in their respec-tive markets. However, the output or pollution created by producing the output of one firm is as-sumed to adversely affect the output of the other. If the polluting firm is forced to pay taxes equal in value to its total external effects, the resulting production and investment policy of the polluting firm will be Pareto optimal, provided other policy alternatives are ignored. If the polluting firm can be connected to a central treatment plant, the taxealternatives are ignored. If the polluting firm can be connected to a central treatment plant, the taxa-tion approach may no longer be the best device for the economy as a whole. If the marginal cost of treatment exceeds the value of the marginal exter-nal effect of the last pollutants to be removed, a mixed approach of taxation and treatment is needed for optimal policy. The treatment approach differs from the taxation approach in that treat-ment charges paid by polluters will in general deviate from the marginal external effect. (Settle-Wisconsin)

CAPITAL AND OPERATING COSTS FOR CON-VENTIONAL AND ADVANCED WASTE TREATMENT. South Tahoe Public Utility District, South Lake Tahoe, Calif.

In: Advanced Wastewater Treatment as Practiced at South Tahoe, Environmental Protection Agency, Water Pollution Control Research Series, August, 1971, p 323-364. 24 tab. EPA Program 17010 ELQ (WPRD 52-01-67).

Descriptors: *Waste water treatment. *Tertiary Maintenance costs, Capital costs, Operating costs, Maintenance costs, Nevada.

Identifiers: *Advanced waste treatment.

The costs of conventional and advanced waste treatment are estimated using data obtained from the conventional-advanced waste treatment scheme at South Lake Tahoe, Nevada. Conventional treatment includes primary clarification, and both plug flow and completely mixed activated sludge secondary treatment. Advanced treatment includes phosphorus removal through lime treatment and lime recalcining, nitrogen removal, recarbonation, filtration, carbon adsorption, and carbon regeneration. The total cost at 7.5 mgd was \$166 per mg for conventional waste treat-ment and \$217 per mg for advanced waste treat-ment. The cost for conventional treatment consists of \$67.50 in capital costs and \$98.50 in operating and maintenance costs. Advanced waste treatment costs are divided into \$74.50 for capital costs and \$142.50 for operating and maintenance costs.

Capital costs are defined as the estimated replacement cost per mg in 1969. These costs are based on producing an extremely high quality reclaimed water with 100 percent reliability. Lesser requirements should expected lower costs. The cost after the cost and the cost of ments should generate lower costs. The cost esti-mates are presented in detail in numerous tables. These cost estimates indicate that tertiary waste treatment adds less than \$9.00 per person per year (See also W72-01493) (Settle-Wisconsin)
W73-02913

MECHANISMS OF SLUDGE THICKENING, Illinois Univ., Urbana. Dept. of Civil Engineering. R. I. Dick. Publ. No. UILU-ENG-71-2012, Sanitary Engineering Series No. 58, Feb. 1971, 145 p, 85 fig. FWQA Research Grant 17070 DJR.

Descriptors: *Activated sludge, *Dewatering, *Settling basins, *Sludge disposal, Flocculation, Biological treatment, Coagulation, Organic load-

ing, Sanitary engineering, Sludge treatment, *Waste water treatment, Visconity. Identifiers: *Sludge thickening, design, Laboratory thickening tests.

This research work deals with the gravity thickening of activated sludges. It included an investigation of the fundamental thickening properties of sludge and consideration was given to the develop-ment of rational criteria for thickener design and operation. An approach to thickener analysis which is based on experimentally determined sludge settling properties, and which permits con-venient evaluation of alternative design or operating conditions was emphasized. The maximum concentration which a sludge can reach by gravity thickening was studied as a function of its com-pressive strength. Also studied were sludge volume index measurements, the relationship between thickening, the application of the method of thickener analysis to full-scale thickeners, and the implications of the work to design for the activated sludge processes. (Smith-EPA) W73-02948

FWQA SETS RULES FOR SEWAGE TREAT-MENT PLANT DESIGN.

Engineering News Record, Vol 185, p 18, October

Descriptors: *Treatment facilities, *Sewage treat-ment, *Design criteria, *Federal project policy, Design, Operation and Maintenance, Efficiencies, Sludge disposal, Flow control, By-passes, Construction. Identifiers: Dry weather flows.

The Federal Water Quality Administration stated new federal guidelines for the design, operation and maintenance of waste water treatment plants The guidelines must be met before federal aid will be given for a treatment plant. The following were some of the guidelines. The project must be completed and in operation within three years of the date of the federal grant offer. The engineering report must specifically indicate anticipated removal efficiencies and total discharge loads per day. Provision for ultimate disposal of sludge must be clearly indicated. Plants should be planned and designed to provide maximum reliability and minimum of primary treatment at all times. Extended by-passing of dry weather flows during construction would not be permitted. (Galwardi-Texas) W73-02958

OXYGEN TRANSFER TO WATER AND TO SODIUM SULFITE SOLUTIONS, British Columbia Univ., Vancouver. For primary bibliographic entry see Field 05G. W73-02962

SALT CREEK TWO STAGE NITRIFICATION PLANT

Federal Water Quality Administration, Cincinnati, Ohio. Advanced Waste Treatment Research Lab. R. L. Woodward.

In: Nitrogen Removal From Wastewaters, Water Pollution Control Research Series, No ORD-17010---October 1970, p 8/1-8/5. FWQA ORD-17010---10/70.

Descriptors: *Municipal wastes, *Ammonia, *Nitrification, Separation techniques, Aeration, Nitrincation, Separation techniques, Acration, Biodegradation, Filtration, Suspended solids, Biochemical oxygen demand, Sludge, Odor, Chlorination, Temperature, Pilot plants, Design criteria, Chemical precipitation, Phosphorus, Denitrification, Nitrogen, *Waste water treatment. *Illinois. Identifiers: *Salt Creek (Ill).

Group 5D—Waste Treatment Processes

Standards for water entering Salt Creek in northern Illinois include: (1) BOD less than or equal to 4 mg/l; (2) suspended solids less than or equal to 5 mg/l; (3) ammonia nitrogen less than or equal to 25 mg/l; and (4) nitrate nitrogen less than or equal to 45 mg/l. Both air stripping and nitrification were investigated as possible methods of ammonia removal, and air stripping was eliminated because of the cold weather experienced during winter. An existing I med plant was converted to a because of the cold weather experienced during winter. An existing I mad plant was converted to a pilot plant for testing the nitrification process, in-cluding two aeration stages for nitrification, biological filters for suspended solids and BOD removals, and chlorination to meet coliform stanremovals, and canomauon to meet common stan-dards. A nitrifying flora developed after the tem-perature reached 60F, and continued to operate even when temperatures reached the 40's. Nutrient removal facilities were also tested, although nutrient removals are not yet necessary. No problems were experienced in feeding sodium aluminate for phosphorus removal, and difficulties encountered in denitrification were related more encountered in defilition to the process employed. Based on these preliminary studies, a 50 mgd plant was designed, including two three hour detention was designed, including two little into detention aeration basins for 2-stage nitrification, clarification, biological filtration, sludge thickening in air flotation thickness, sludge digestion, and chemical feed facilities for nutrient removals. (See W72-04085 thru W72-04092) (Lowry-Texas)

ACTIVATED SLUDGE PROCESSING.

Organisatie voor Toegepast Natuurwetenschap-pelikj Onderzoek, The Hague (Netherlands). (as-

A. Pasveer. U.S. Patent No 3,622,507, 4 p, 2 fig, 2 tab, 2 ref; Official Gazette of the United States Patent Office, Vol 892, No 4, p 1448, November 23, 1971.

Descriptors: *Patents, *Activated sludge, *Biological treatment, *Bacteria, Organic matter, Pollu-tion abatement, Waste treatment, *Waste water Identifiers: Alkaline hydrolysis.

The organic constituents of the sludge which are difficult to decompose bacteriologically are split by alkaline hydrolysis at elevated temperatures into smaller molecules which can be quickly conmto smatter motecutes which can be quickly converted bacteriologically. An easily separable residue is separated and the remaining solution containing a large part of the decomposed organic matter of the original sludge is recycled into the activated sludge process. (Sinha-OEIS) W73-02981

PROCESS OF PURIFYING WATER BY IR-

RADIATING IT, Osaka Prefecture (Japan). (assignee) K. Tanito, N. Kato, S. Kinoshita, M. Kinoshita, and T. Sunada.

U.S. Patent No 3,620,944, 3 p, 2 ref; Official Gazette of the United States Patent Office, Vol 892, No 3, p 1075, November 16, 1971.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, *Irradiation, *Mecury, *Insecticides, Industrial wastes, *Agricultural

Identifiers: *Ionizing radiation, Parathion, Phenyl mercuric acetate, Methyl mercuric chloride.

Water containing parathion, phenyl mercuric acetate or methyl mercuric chloride can be purified by irradiating it with ionizing radiation. The dosage may vary from 5,000 to 1,000,000 rads depending on the pollutant concentration. (Sinha-OEIS) W73-02982

SEWAGE TREATMENT SYSTEM, FMC Corp., San Jose, Calif. (assignee) J. J. Pizzo, and M. F. McNeil.

U. S. Patent No 3,622,511, 3 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 892, No 4, p 1449, November 23, 1971.

Descriptors: "Patents, "Evaporation, Pollution abatement, Equipment, "Harbors, "Inland water-ways, Ships, "Sewage treatment, Water pollution control, Water quality control," "Waste water treat-

Raw sewage is macerated and supplied to an evaporator where water is driven off as steam evaporator where water is recovered. A submersed burner is used in the evaporator to consume com-bustibles such as oils and paper. This evaporator may be used with salt water as well as fresh water. (Sinha-OEIS) W73-02983

AERATING APPARATUS, Passavant-Werke, Michelback (West Germany). Michelbacherhutte. (assignee) J. Muskat, D. Klump, and J. Sieckmann. U.S. Patent No 3,620,512, 5 p. 12 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 892, No 3, p 989, November 16, 1971.

Descriptors: *Patents, *Aeration, *Rotors, Equipment. *Waste water treatment, Pollution abatement, "Biological treatment, "Sewage treatment,
"Liquid wastes, Water pollution control, Water
quality control, Oxygenation.

The aerating equipment consists of a flotable frame and a bladed aeration rotor which can be rotated as the frame moves along a predetermined path on the water surface. The apparatus moves the liquid in a direction at an angle of between 90 and 180 deg with respect to the path of motion of the frame. (Sinha-OEIS)
W73-02984

SEWAGE TREATMENT APPARATUS,

Air-Gest International Corp., Montreal (Quebec). (assignee)

U.S. Patent No 3,618,779, 3 p, 3 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 892, No 2, p 576, November 9, 1971.

Descriptors: *Patents, *Sewage treatment, Equipment, Pollution abatement, *Acration, *Waste water treatment, Water Pollution control, Water pollution, Water quality control, Water pollution

The apparatus consists of a tank having an inlet for raw sewage and an outlet for decomposed sewage. An inclined baffle is centered to divide the tank into an aeration chamber and a settling chamber. Air is delivered under pressure and forms a countercurrent flow causing mixing and aeration in both sections. As the sewage is aerated and decomposed, supernatant liquid and finely divided solids in suspension find their way to the undisturbed area behind the baffle in the settling chamber from where they flow from the tank to the outlet. (Sinha-OEIS) W73-02987

REMOVAL OF DISSOLVED OXYGEN FROM WATER

Mobile Oil Corp., New York. (assignee)

E. S. Snavely, Jr.
U.S. Patent No 3,618,667, 4 p. 9 fig, 10 ref; Official Gazette of the United States Patent Office, Vol 892, No 2, p 549, November 9, 1971.

Descriptors: *Patents, *Dissolved oxygen, *Hydrogen sulfide, *Metals, Cobalt, Nickel, *Waste water treatment, Water pollution treatment, Water pollution, Water quality, Water quality control, Pollution abatement. Identifiers: *Chemical treatment.

A method is described for treating water which contains hydrogen sulfide and oxygen dissolved therein. A transition metal is added to the water to catalyze the reaction there by removing the oxygen from the water. Cobalt or nickel may be used as the transition metal. (Sinha-OEIS)

PROCESS FOR DETOXIFYING CYANIDE WASTE WATERS.

Du Pont de Nemours (E. I.) and Co., Wilmington, Del. (assignee)
B. C. Lawes, and O. B. Mathre.

U.S. Patent No 3,617,582, 6 p, 5 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 258, November 2, 1971.

Descriptors: *Patents, *Chemical wastes, *Industrial wastes, *Poisons, *Waste water treatment, Magnesium compounds, Pollution abatement, Water pollution control, Water quality control, Water pollution treatment, Waste treatment, Treatment.

Identifiers: *Cyanide, Electroplating waters, *Chemical treatment, Formaldehyde, Magnesium salt, Hydrogen peroxide.

A process is described for detoxifying cyanide anions present in water by forming a solution with hydrogen peroxide and formaldehyde at a temperature within the range of about 50 to 180F and at a pH within the range of about 9 to 12.5. When zinc cyanide electroplating waters are to be detox-ified, a magnesium salt such as Epsom salt (mag-nesium sulfate heptahydrate) may be preferred. Sinha-OEIS) W73-02989

REMOVAL OF PHOSPHATE FROM WASTE WATER.

The Dow Chemical Co., Midland, Mich. (assignee) S. L. Daniels, and D. G. Parker. U.S. Patent No 3,617,569, 4 p., 3 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 256, November 2, 1971.

Descriptors: *Patents, *Phosphates, *Nutrient Descriptors: "Patents, "Phosphates, "Nutrient removal, "Waste water treatment, "Liquid wastes, Pollution abatement, Flocculation, Treatment, "Metals, Aluminum, Iron, Calcium, Water pollution treatment, Water pollution, Water pollution control, Water quality control.

Identifiers: Chemical treatment, Lanthanide.

Phosphates may be removed from waste water by adding at least about two equivalents of aluminum, iron, or calcium ion based on the phosphate ion present and mixing for about one-half minute. The next step is to add one equivalent of lanthanide metal, yttrium, scandium, or hafnium or a mixture of these metals. A second half-minute mixing is desirable in conjunction with the second step. Separation is facilitated by the use of a flocculations. ing agent. (Sinah-OEIS) W73-02990

PROCESS AND A PRODUCT FOR THE PURIFI-CATION OF POLLUTED WATER FROM HEAVY METAL IONS PRESENT THEREIN, Research A.B., Syndbyberg (Sweden). (assignee)

K. O. H. Fuxelius.
U. S. Patent No. 3,617,563, 4 p, 1 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 255, November 2, 1971.

*Patents, *Mercury, *Lea *Copper, *Metals, *Heavy metals, Resins, Ion exchanger, Pollution abatement, Treatment, *Waste water treatment, Liquid wastes, Water pollution treatment, Water pollution, Water pollution control, Water quality control. Identifiers: *Epoxidized black
*Epichlorohydrin, *Dichlorohydrin, *Thiol.

Heavy metal water by use water is passe and heavy me bound very f whether or no centration. Bi variations in the for the purific (a) black liq dichlorohydrin (Sinha-OEIS) 73-02992

NEUTRALIZA NTAINING A ecretary of signee) signee)
A. Cywin, and
U. S. Patent N cial Gazette o Vol 892, No 1,

Descriptors: Metals, Sulfa Mine wastes, *Liquid waste: Identifiers: *C Acid waste

neutralized by tion of the ferr tacting the o neutralized fro ferrous-ferric W73-02993

IMESTONE ACID WASTE Secretary of t nee) M. Deul, and H U. S. Patent N Official Gazet

Descriptors: water, *Acid a water treatm Neutralizatio treatment, Watton, Water qu

The process of water in a rota through the mi limestone. The a stoichiometr waste acid stre ing dissolved the range of 5 to strip dissol product stream ples are cit procedures. (S W73-02994

NEUTRALIZA NTAINING AC Secretary of t signee)
A. Cywin.
U. S. Patent N.
Gazette of the
892, No 1, p 25

Descriptors: * acids, *Mine *Oxidation, Ironent, Pollution Identifiers: *P iron, *Limesto

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Waste Treatment Processes—Group 5D

Heavy metal ions are absorbed from polluted Heavy metal ions are absorbed from political water by use of an ion exchanger based on eposidized black liquor. When mercury-containing water is passed through an ion exchanger mercury and heavy metal ions such as lead and copper are bound very firmly to the resin, irrespective of whether or not other ions are present in high conwhether or not other ions are present in high con-centration. Eight examples are cited to illustrate variations in the procedures. The product selected for the purification may be a reaction product of (a) black liquor, (b) epichlorohydrin or 1,2 dichlorohydrin and if desired (c) a thiol compound. (Sinha-OEIS) W73-02992

NEUTRALIZATION OF FERROUS IRON-CO-NTAINING ACID WASTES, Secretary of the Interior, Washington, D.C. (as-

signee; A. Cywin, and E. A. Mihok. U. S. Patent No. 3,617,562, 4 p, 3 fig, 9 ref; Offi-cial Gazette of the United States Patent Office, Vol 892, No 1, p 255, November 2, 1971.

Descriptors: *Patents, *Industrial Descriptors: "Patents, "Industrial wastes, 'Metals, Sulfates, Chlorides, "Acid mine water, Mine wastes, Neutralization, "Iron, Treatment, 'Liquid wastes, "Waste water treatment, 'Lidentifiers: "Chemical treatment, "Pickle liquors.

Acid waste streams containing iron salts are neutralized by catalytically oxidizing at least a por-tion of the ferrous iron to the ferric state then conuon of the ferrous from to the ferric state then con-tacting the oxidized stream with at least a stoichiometric quantity of an alkaline agent to neutralized free acid, and to precipitate a mixed ferrous-ferric iron oxide. (Sinha-OEIS) W73-02993

LIMESTONE NEUTRALIZATION OF DILUTE ACID WASTE WATERS, Secretary of the Interior, Washington, D.C. (as-

signee)
M. Deul, and E. A. Mihok.

M. Deul, and E. A. Minok. U. S. Patent No. 3,617,560, 4 p, 2 fig, 2 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 255, November 2, 1971.

Descriptors: *Patents, Acid streams, Acidic water, *Acid mine water, *Mine drainage, *Waste water treatment, *Liquid wastes, *Aeration, *Neutralization, Limestones, Water pollution treatment, Water pollution control, Water pollution tion, Water quality control.

The process consists of grinding limestone with water in a rotating mill and limiting flow of water through the mill to generate a slurry of particulate limestone. The next step consists of mixing at least a stoichiometric amount of the slurry with the waste acid stream to produce an effluent containing dissolved carbon dioxide and having a pH in the range of 5 to 6. The effluent stream is aerated to strip dissolved carbon dioxide and produce a product stream having a pH above 6.5. Four examples are cited showing variations in the procedures. (Sinha-OEIS)

NEUTRALIZATION OF FERROUS IRON-CO-

NTAINING ACID WASTES, Secretary of the Interior, Washington, D.C. (assignee) A. Cywin.

U.S. Patent No. 3,617,559, 3 p 2 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 255, November 2, 1971.

Descriptors: *Patents, *Acid mine water, *Mine acids, *Mine drainage, Metals, *Neutralization, *Oxidation, Iron compounds, *Waste water treatment, Pollution abatement, Treatment. Identifiers: *Pickle liquors, Metal salts, *Ferrous iron, *Limestone, Chemical treatment, Hydrous oxides.

Acid waste waters containing dissolved metal salts, especially iron salts in the ferrous oxidation saits, especiasity not saits in the terrous oxidation state are neutralized and the metal saits precipitated as hydrous oxides by use of a limestone slurry neutralizing agent. The waste waters are mixed with at least a stoichiometric amount of limestone to neutralize the free acid and amount of limestone to neutralize the free acid and the mixture is then passed to an aeration step where carbon dioxide is stripped and at least par-tial oxidation of the ferrous iron occurs. Precipitated sludge containing substantial quanti-ties of iron oxides are separated out. A portion of the sludge may be recycled. (Sinha-OEIS) W73-02995

REMOVAL OF PHOSPHATES FROM SEWAGE

REMOVAL OF PHOSTHATES FROM SEWAGE EFFLUENT, Nalco Chemical Co., Chicago, Ill. (assignee). R. A. Boehler, and M. R. Purvis, Jr. U.S. Patent No 3,617,542, 3 p, 1 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 251, November 2, 1971.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Phosphates, Nutrient removal, *Bacteria, *Biochemical oxygen demand, Polymers, Aluminum, Treatment, Water quality control, Pollution statement, Water pollu-tion control, Water pollution, Water pollution treatment Identifiers: *Chemical treatment, *Alum, *Sodium

The effluent from a clarifier in a sewage treatment plant is mixed with a high molecular weight linear anionic polymer having a weight average molecu-lar weight in excess of 100,000. Then by adding an aluminum compound, (sodium aluminate and/or alum) to the supernatant liquid it facilitates the precipitation of dissolved orthophosphate and separation of the settled and precipitated solids. After removing the heavy solids the effluent may be subjected to a bacterial treatment. (Sinha OEIS) W73-03000

BIOGRID UNIT AND METHOD,

Fairbanks, Morse and Co., Chicago, Ill. (assignee). U.S. Patent No 3,617,541, 3 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 250, November 2, 1971.

Descriptors: *Patents, Equipment, *Microorgan-isms, *Biological treatment, *Aeration, Nutrients, Oxygen, *Aerobic treatment, Sewage treatment, *Waste water treatment, Pollution abatement, Water quality control, Water pollution control.

A biogrid unit includes permeable sheet panels af-fording growth areas for microorganisms. The panels are constructed of a material which has capillary action capabilities so that moisture is supplied to the microorganisms regardless of the liquid level in the tank. The unit may be aerated so that oxygen and nutrient requirements of the nat oxygen and nutrient requirements of the microorganisms may be met and the panels are free to sway, oscillate or move to increase the mass transfer of oxygen and nutrients to the microorganisms. (Sinha-OEIS)

REMOVAL OF NITROGEN AND PHOSPHORUS FROM WASTE WATERS, Secretary of the Interior, Washington, D.C. (as-

signee).

D. F. Bishop, and J. B. Stamberg. U.S. Patent No 3,617,540, 4 p, 2 fig, 2 tab, 8 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 250, November 2, 1971.

*Patents, *Nutrient Descriptors: *Nitrogen, *Phosphorus, Bicarbonates, *Phosphates, *Nitrates, *Denitrification, Lime, *Waste water treatment, Domestic wastes, Industrial wastes, Pollution abatement, Water pollution control, Water quality control, Water treatment. Identifiers: Calcium phosphate.

The process for removing nutrients from stream containing bicarbonate ion, phosphates and nitrogen compounds, consists of the following: converting nitrogen compounds to the nitrate form by biological nitrification, then adding sufficient lime to the effluent to insolubilize in the form of ame to the effluent to insolubilize in the form of calcium phosphate compounds all of the phosphates contained in the water stream. The in-solubilized calcium phosphate is separated out and the nitrates are converted to nitrogen gas by biological denitrification. (Sinha-OEIS) W73-03002

PROCESS FOR REMOVING CONTAMINANTS FROM WASTE-WATER, Standard Oil Co. of Indiana, Chicago, Ill. (25-

signee)

J. F. Grutsch, and R. C. Mallatt. U.S. Patent No 3,617,539, 5 p, 1 fig, 1 tab, 12 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 250, November 2, 1971.

Descriptors: "Patents, "Waste water treatment, "Biological treatment, "Coagulation, Treatment, "Floculation, "Aquatic microorganisms, Pollution abatement, Water pollution treatment, Water pollution, Water pollution control.

Improved waste water purification is achieved by improved waste water purneauton is achieved by first passing the waste-water through a biological treating zone, and then adding a coagulating agent. The presence of peptized or unflocculated biological solids in the effluent from the biological treating zone is responsible for the improved contaminant removal. In this process less coagulating coats is extended to the coagulating coats in the coagulating coa agent is required than in the prior art. (Sinha-OEIS) W73-03003

BIOCHEMICAL SEWAGE TREATMENT VIA HIGH PURITY MOLECULAR OXYGEN, Snyder (George E.) Associates, Inc., Jackson,

Mich. (assignee). F. L. Vermette.

U.S. Patent No 3,617,537, 3 p, 7 fig, 14 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 249, November 2, 1971.

Descriptors: *Patents, *Liquid wastes, *Oxygenation, *Aeration, *Clarification, Pollution abatement, Activated sludge, *Sewage treatment, Lagoons, *Aerobic treatment, *Biological treat-ment, *Waste water treatment, Water pollution

This procedure uses high purity molecular oxygen in the treatment of organic liquid wastes. An apparatus is provided for improving the phosphorus removing capacity of an activated sludge sewage treatment plant which has an aerator and a clarifier receiving the mixed liquor effluent from an aera-tor. The improved aerobic biochemical purification is accomplished by dissolving high-purity oxygen under pressure into water and mixing the ox-ygen-charged water with the waste water. The process can be used with a lagoon method of aero-bic biological sewage treatment as well as with an activated sludge sewafe treatment. (Sinha-OEIS) W73-03004

OXIDATIVE WASTE DISPOSAL,

Du Pont de Neumours (E. I.) and Co., Wilmington, Del.

E. S. Monroe, Jr.

U.S. Patent No 3,611,954, 4 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 891, No 2, p 584, October 12, 1971.

Descriptors: *Patents, *Liquid wastes, *Chemical wastes, *Organic wastes, *Vaporization, *Oxida-

Group 5D-Waste Treatment Processes

tion, Equipment, Pollution abatement, Water quality control, Water pollution control, Water pollution treatment.

A process is described for the oxidative disposal of liquid waste made up of organic materials diluted with water. It consists of spraying the waste counter to a combustion flame as an envelope. The waste stream is vaporized and the products are moved past an oxidative catalyst. Final products such a CO2 and water may be removed separately. (Sinha-OEIS)

POROUS SUPPORT TUBES FOR REVERSE OS-MOSIS.

Westinghouse Electric Corp., Pittsburgh, Pa. (assignee).

For primary bibliographic entry see Field 03A. W73-03009

APPARATUS FOR BIOLOGICALLY PURIFY-

ING SEWAGE, Aktiebolaget Gustavsbergs Fabriker (Sweden).

(assignee). A. O. W. Hellqvist.

A.O. w. Ficultists.
U.S. Patent No 3,613,890, 2 p, 2 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 891, No 3, p 1086, October 19, 1971.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Aeration, *Aerobic treatment, Aerobic bacteria, Aquatic microorganisms, Sewage bacteria, Nitrogen, Nutrient removal, Rotors, Aerators, Pollution abatement, Water pollution treatment, Water pollution control, Water pollution, Water quality control, Equipment.

A trough or open tank with a sewage inlet and outlet is provided. The aerator consists of a rotor having a horizontal shaft with circular plates which extend downward into the sewage. Vanes are ecextend downward into the sewage. Variety of centrically placed causing air to circulate more thoroughly. The sewage is aerated to reduce the nitrogen content with the aid of aerobic microorganisms. (Sinha-OEIS) W73-03014

MUNICIPAL AND INDUSTRIAL WASTE WITH LIMITED WATER RESOURCES, Hill, Ingman, Chase and Co., Seattle, Wash

For primary bibliographic entry see Field 05F. W73-03127

DISCUSSION OF WASTE DISPOSAL IN ARID

Arizona State Univ., Tempe. Dept. of Civil Engineering.

For primary bibliographic entry see Field 05F. W73-03129

EFFLUENT AND WATER QUALITY CONTROL OF A SYNTHETIC FIBER PULP MILL (AB-WASSER UND GEWAESSERSCHUTZ EINER KUNSTFASERZELISTOFFABRIK). O. Seppovaara.

Paperi ja Puu Vol 50, No 3, p 97-102, 1968. 3 fig, 4 ref. English summary.

Descriptors: Water pollution control, Water pollution sources, Pollution abatement, Non-structural alternatives, *Sulfite liquors, *Pulp wastes, *Waste water treatment, Water pollution effects, Abatement, Reclaimed water, Water pollution treatment, Water quality control, Sulfur compounds, *Industrial wastes, Pulp and paper industry, Cellulose, Biochemical oxygen demand, Organic wastes, Wood wastes, Oxygen, Dissolved oxygen, Oxygen demand. Identifiers: *Rayon production wastes, *Finland.

The largest consumers of water, and the ones who The largest consumers of water, and the ones who pollute it most, are sulphite pulp mills. The drawbacks attributable to them are connected with the high biochemical oxygen demand (BOD) of the wastewater. In Finland, a successful solution for water protection is represented by the 3-stage pulping method with soluble sodium base, employed by Rauma-Repola Osakeyhtio, who mainly produce rayon pulp; the method enables almost complete recovery of the waste liquor (95-98%) and the regeneration of chemicals. Physico-chemical, biological, bacteriological, and fish-economic and the regeneration of chemicals. Physico-chemi-cal, biological, bacteriological, and fish-economic aspects were included in extensive investigations. Details are discussed, indicating the distribution and the effects of waste waters. (LeGore-Washington) W73-03157

ABORATORY STUDIES ON THE SURVIVAL OF POLIOVIRUS IN ALGAL-BACTERIAL WASTEWATER TREATMENT SYSTEMS, California Univ., Berkeley. School of Public Monthly Systems, California Univ., Berkeley.

Health.

M. D. Sobsey, and R. C. Cooper.
In: Virus and Water Quality: Occurrence and Control, Proceedings, Thirteenth Water Quality Conference, Illinois, Univ., Urbana-Champaign, p 137-147, Feb 15-16, 1971. 4 fig, 3 tab, 16 ref.

Descriptors: *Water treatment, *Waste water treatment, *Viruses, Bacteria. Identifiers: *Virus survival.

Laboratory studies were conducted on the survival of a model enteric virus, poliovirus type 1, in batch cultures of algae and bacteria. Considerable anti-viral activity was observed in both stabilization pond water and algae-bacteria cultures. Bac-teria cultures showed less virus activating capacity, and a pure culture of the alga, Scenedesmus quadricauda, had none. Antiviral activity appears to be associated with either biological activity or heat labile factors, but the specific causes have yet to be identified. (See also W73-03173) (Bean-AW-WARF) W73-03178

WET OXIDATION OF NYLON 6,6 BY THE ROTATING DISK TECHNIQUE. Connecticut Univ., Storrs. Dept. of Chemical En-

gineering.
A. J. Luciano.
MS Thesis, 1972, 96 p, 14 fig, 4 append, 35 ref.
OWRR-A-019-CONN (1). 14-01-0001-1626.

Descriptors: *Oxidation, Plastics, *Resins, *Waste water treatment, Kinetics, Pressure, Temperature, Time, Rotations, Degradation (Decom-

position).

Identifiers: *Nylon 6,6, Polyethylene, Polyvinyl chloride, Polymethyl methacrylate, Polypropylene, Stoichiometric ratio, Activation energy, *Rotating disk geometry, *Thermoplastic resins, *Wet air oxidation.

A study of the kinetics of wet-air oxidation of polymers was made using a rotating disk geometry. The mathematical model of this system offers a well defined hydrodynamic situation and can be solved analytically. Several commonly can be solved analytically. Several commonly available polymers (Polyvinyl chloride, Polymethyl methacrylate, Polypropylene, Polyethylene) were examined in exploratory experiments. Nylon 6,6 was studied in greater depth because its physical properties were better suited to the experimental technique used. The effect of independent parameters (pressure, temperature, time, and revolutions of disk) on the dependent variable (amount of Nylon degraded) was invariable (amount of Nylon degraded) was investigated. From the dependence of the reacted Nylon on the revolutions of the disk at two different temperatures, the stoichiometric ratio of Nylon to oxygen consumed and the order of the reaction were calculated. Finally, the activation energy was calculated and the results were tested on a new set of data.

W73-03186

SYSTEMS APPROACH TO PROBLEMS OF WATER POLLUTION CONTROL, Michigan Univ., Ann Arbor. School of Public Health. For primary bibliographic entry see Field 05G. W73-03222

SYSTEMS APPROACHES TO MICROSCALE PROBLEMS OF WATER POLLUTION CON-

TROL, Texas A and M Univ., College Station. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 05G.
W73-03223

GROUP ANALYSIS OF IMPURITIES IN RE-CALIMED WATER (IN RUSSIAN), For primary bibliographic entry see Field 05A. W73-03246

5E. Ultimate Disposal of Wastes

PHYSICO-CHEMICAL LIMNOLOGY AND PERIPHYTON IN A WARM-WATER STREAM RECEIVING WASTEWATER TREATMENT RECEIVING WASTEWATER TREATMEN PLANT EFFLUENT, Illinois Univ., Urbana. Water Resources Center. For primary bibliographic entry see Field 05D. W73-02603

CONDITIONING PROCEDURES FOR WASTE ACTIVATED SLUDGE DISPOSAL, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. For primary bibliographic entry see Field 05D. W73-02616

WASTE MANAGEMENT, Babcock and Wilcox Co., Lynchburg, Va. Power Generation Div. For primary bibliographic entry see Field 05B. W73-02734

AQUATIC RADIOLOGICAL MONITORING BROWNS FERRY NUCLEAR PLANT,
Tennessee Valley Authority, Muscle Shouls, Ala. Div. of Environmental Research and Development.

For primary bibliographic entry see Field 05B. W73-02736

EFFECT OF BRINE DISPOSAL COST ON HYPERFILTRATION PLANT OPTIMIZATION, Oak Ridge National Lab., Tenn. W. L. Griffith, R. M. Keller, D. G. Thomas, and

W. J. Boegly, Jr.
Desalination, Vol 11, No 1, p 91-112, August, 1972. 6 fig, 7 tab, 22 ref.

Descriptors: *Optimization, *Brine disposal, Brines, Waste disposal, Water costs, Costs, Design. Identifiers: *Hyperfiltration, *Hyperfiltration plant, *Brine disposal cost, Parametric analysis.

Parametric studies of hyperfiltration were carried out (1) to determine optimal flow conditions and relative water costs when waste brine disposal costs are included in an economic model, and (2) to further investigate tapered plant geometrics. Relative water costs were computed at optimum flow conditions by using a Fortran computer program which deals with a single-stage hyperfiltra-tion system with tubular membranes under turbutent conditions. Under the conditions investigated, the optimum permeability of an ion-exchange type membrane, which gave the minimum relative

water cost, de creased. Also creased with in relative water necessarily the costs contribu water costs de membrane wa requirements total water rec cost appeared design optim plants. (Settle-W73-02914

COST ANAL OF SHIPBOAL Center for Systems Evalu C. H. Piersall, Available from tion Service a \$0.95 in micro Professional F

Descriptors: * *Ships, *Cos costs, Treatme Identifiers: Al

The cost of in for disposal analyzed. The treatment utili some back-up ing tanks with ment. (3) on-l aboard barges treatment ash and transfer. modified versi ly, both wast treated in the each option is costs amortiz operating cos vestments in Operations co operations, properations. Be option of usin sequent disch the least costly ly within coast may be requir tle-Wisconsin W73-02916

OXIDATIVE Du Pont de Ne Del. For primary bi W73-03008

DISCUSSION LANDS, Arizona State gineering. For primary bi W73-03129

SITES OF LIQUID-WAS NORTH QUA Geological Sur For primary bi W73-03154

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Water Treatment and Quality Alteration—Group 5F

water cost, decreased as the brine disposal cost increased. Also, the optimum water recovery increased with increased disposal cost. The optimum relative water costs employed in the study are not necessarily the cost of water. For the membrane and feed characteristics studied, brine disposal costs contributed from 10 to 85 percent of product water costs depending on the extent to which the membrane was strained to meet product water requirements and hence on the extent to which total water recovery was possible. Brine disposal cost appeared to be an important factor in the design optimization of inland hyperfiltration plants. (Settle-Wisconsin) W73-02914

COST ANALYSIS OF OPTIONAL METHODS OF SHIPBOARD WASTE DISPOSAL, Center for Naval Analysis, Arlington, Va.

Systems Evaluation Group.
C. H. Piersall, Jr., and R. E. Borgstorm.
Available from the National Technical Information Service as AD-744 192, \$3.75 in paper copy, \$0.95 in microfiche. Center for Naval Analysis Professional Paper No 91, January, 1972. 20 p, 4

Descriptors: *Waste disposal, *Waste treatment, *Ships, *Costs, Installation costs, Operating costs, Treatment facilities, Investment.

Identifiers: Alternatives

tab. 5 ref.

The cost of introducing any of four major options for disposal of shipboard domestic waste is analyzed. The four major options are (1) on-board treatment utilizing marine sanitation devices with some back-up holding capacity, (2) on-board holding tanks with direct discharge ashore for treat-ment, (3) on-board holding tanks with treatment aboard barges, and (4) on-board holding tanks with treatment ashore, using barges for the collection and transfer. Cost analyses are also presented for modified versions of options one and three; name ly, both waste and sewage are assumed to be treated in these modified versions. The cost of each option is defined as the sum of installation costs amortized over the life of the system and operating costs. Investment costs consist of investments in the ships, piers, barges, and tugs. Operations costs consist of costs involved in ship operations, pier operations, and barge and tug operations. Based on the available cost data, the option of using shipboard holding tanks for subsequent discharge directly to pier connections is the least costly. However, for ships operating solely within coastal waters, shipboard treatment units may be required due to operational reasons. (Set-tle-Wisconsin) W73-02916

OXIDATIVE WASTE DISPOSAL, Du Pont de Neumours (E. I.) and Co., Wilmington, For primary bibliographic entry see Field 05D.

DISCUSSION OF WASTE DISPOSAL IN ARID Arizona State Univ., Tempe. Dept. of Civil Engineering. For primary bibliographic entry see Field 05F. W73-03129

SITES OF SOLID-WASTE STORAGE AND LIQUID-WASTE DISCHARGE, HARTFORD NORTH QUADRANGLE, CONNECTICUT, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 07C. W73-03154

STUDY OF THE POLLUTION OF THE LAGOON AT TAHITI BY FECAL GERMS (IN

Hopital des Armees, Marseille (France). For primary bibliographic entry see Field 05B. W73-03181

5F. Water Treatment and **Quality Alteration**

THE PREPARATION AND OXIDATIVE PRO-PERTIES OF FERRATE ION (FEO42-), STU-DIES DIRECTED TOWARD ITS USE AS A WATER PURIFYING AGENT,
Missouri Water Resources Research Center,

R. K. Murmann.

Available from the National Technical Informa-Available from the National Technical Informa-tion Service as PB-213 505, \$3.00 in paper copy, \$0.95 in microfiche. Missouri Water Resources Research Center, Columbia, Completion Report, October 1972. 24 p., 3 fig, 5 tab. OWRR A-050-MO (1) 14-31-0001-3525.

Descriptors: *Water purification, *Water treat-ment, *Iron oxides, Metals, Water pollution treat-ment, Iron, Manganese, Cadmium, Mercury, Lead, Cobalt, Nickel, Boron. Identifiers: Arsenic.

The use of FeO42- in the treatment of deep-well and Missouri River water has been evaluated with respect to many variables. The addition of FeO42-effectively reduced the amounts of iron, manganese, cadmium, mercury, lead, cobalt, nickel, arsenic, and boron to values less than the detectable quantities with available instrumentation. This is done with less than 50 ppm of added Na2FeO4. The presence of river silt has no effect and the reagent is effective above a pH of 7. In more acidic water some base such as CaO must be added but less than is presently being used in plants around the country. For iron removal, 1-2 ppm FeO42-removes iron to less than .02 ppm with an easily removes iron to less than ...2 ppm with an easily filterable precipitate. Any excess FeO42- decomposes in 15-20 minutes (depending on temperature and acidity) precipitating Fe (OH3) and giving O2 to the system. Almost no residual reagent remains. Organic substances are oxidized to CO2 and N2 ultimately while H2S goes to S8 and NO2, NH3 to NO3- and N2, respectively. FeO42- is extremely deadly to many river water bacteria as well as to selected strains of laboratory bacteria. W73-02608

EVALUATION POTABLE OF

STORAGE TANKS, Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Sanitary Sciences For primary bibliographic entry see Field 05G. W73-02656

INFLUENCE OF TEMPERATURE ON TASTE INTENSITY AND DEGREE OF LIKING OF DRINKING WATER, California Univ., Davis. Dept. of Food Science

and Technology.
R. M. Pangborn, and L. L. Bertolero.
Journal of the American Water Works Association, p 511-515, August 1972. 3 fig, 5 tab, 8 ref.

Descriptors: "Taste, "Potable water, "Tempera-ture, Water supply, Dissolved solids, Heating, Cooling, Mineral water. Identifiers: Degree of liking, Hedonic response.

The degree to which a person reacts to dissolved minerals in water varies with the temperature. The intensity of taste is greatest for water at body temperature and room temperature, and is signifi-cantly reduced by chilling or heating. Tests on characteristic taste intensities of eight minerals at

1000 ppm and at 750 ppm indicate that intensities were reduced significantly by lowering the solu-tion temperature. The less the taste intensity the tion temperature. The less the taste intensity the greater the degree of liking, indicating that the sub-jects expected drinking water to be taste free. With natural drinking waters, taste intensity was directly related to the mineral content of the samples tested (38-2460 ppm) and was related to solu-tion temperature in the same manner as were the mineralized waters. (Oleszkiewicz-Vanderbilt) W73-02779

MASS TRANSFER AND CHEMICAL REAC-TION IN TWO-PHASE FLOW, Delaware Univ., Newark. Dept. of Chemical Engineering. For primary bibliographic entry see Field 05D. W73-02875

BIOASSAYS OF QUALITY IN WATER RESOURCES OF MAJOR IMPORTANCE TO NEW MEXICO, New Mexico State Univ., University Park, Water Resources Research Inst. For primary bibliographic entry see Field 05C. W73-02876

COST ALLOCATION FOR A REGIONAL POL-LUTION TREATMENT SYSTEM. For primary bibliographic entry see Field 05G. W73-02937

WATER-TREATMENT-PLANT WASTE DISPOSAL-ACTION NOW,
American Water Works Association Research
Foundation, New York. H. A. Faber, and A. D. Nardozzi. Journal of the American Water Works Associa tion, Vol 64, No 10, Part 1, p 674-680, October 1972. 2 fig, 5 tab, 3 ref.

Descriptors: "Sludge treatment, Water purifica-tion, Water softening, Pumping, Dewatering, "Water treatment, Filtration. Identifiers: "Sludge production, "Unit processes, Filter washwater, Ion exchange regenerant, Byproduct recovery

Sludge and filter washwater treatment considerasingle and mice washwater purification and softening facilities are discussed. Sludge production and handling were related to sludge types, suspended and dissolved solids removal chemissuspended and dissolved solods removal chemis-try, raw water quality, qualitative and quantitative physical-chemical constituents, treatment plant ef-ficiency, and sludge withdrawal methods. Methods to determine solids in filter backwash and total dissolved solids in ion exchange regenerant streams are presented. Potential correlations of raw and treated water parameters to sludge production are given. Other considerations include problems in pumping and gravity flow, unit processes or process sequences under development to dewater or recover by-products, development to dewater or recover by-products, and the work of Pennsylvania water utilities to solve their problems. Two phases of work are described to establish uniform sampling, analysis, and categorization techniques for all types of water treatment plant wastes and evaluate polyelectrolytes for use as primary coagulants, coagulant aids, and sludge conditioning agents. Putter, research needs, recommendations, and Future research needs, recommendations, and conclusions are enumerated. (See also W72-12800) conclusions are enumer (Nardozzi-AWWARF) W73-02964

PRECOAT VACUUM FILTRATION AND NATU-RAL-FREEZE DEWATERING OF ALUM SLUDGE, Smith and Mahoney, Albany, N.Y. P. F. Mahoney, and W. J. Duensing.

Group 5F-Water Treatment and Quality Alteration

Journal of the American Water Works Associa-tion, Vol 64, No 10, Part 1, p 665-669, October 1972. 1 fig, 2 tab.

Descriptors: "Dewatering, Landfills, Costs, Filtra-tion, "Sludge treatment, "Water treatment. Identifiers: "Rotary vacuum precoat filtration, "Natural freezing, Aluminum hydroxide sludge, Operating parameters, Filtrate quality, Cake solids.

A testing program is described to determine critical parameters to dewater gelatinous aluminum hydroxide sludge economically. The Environmen-tal Protection Agency provided funds for a pilot facility to: demonstrate the technical feasibility of tactity to: demonstrate the technical reasonary of dewatering alum sludge by rotary vacuum precoat filtration; determine optimum operating condi-tions; develop plant scale cost estimates; describe the effect of natural freezing on dewatering of dilute and concentrated sludge mixtures; and determine the optimum maximum layer thickness to be frozen. The rotary vacuum precoat filtration operation is described. The variables studied included sludge solids cake, filter aids, drumspeeds, knife advance rate, filter drum submergence, filter rate, cake moisture, and filtrate quality. Sludge was pumped from the settling basins to a con stantly agitated feed tank, then to a filter bowl. A 20% cake solids with filtrate quality < 5 JTU was achieved at 5 gal/sq ft/hr. The cake can be used as landfill. Polymer conditioning was not beneficial at Albany. Sludge treatment costs are estimated at Aloany. Studge treatment costs are estimated at \$6.05/mg treated water and \$9.25/1000 gal of sludge. A 4 ft sludge depth was frozen in layers. Good liquid-solids separation was obtained following thawing. (See also W72-12799) (Nardozzi-AW-WARF) W73-02965

AN EPIDEMIOLOGICAL STUDY OF THE EF-FECT OF FLUORIDES IN DRINKING WATER ON THE FREQUENCY OF SLIPPED CAPITAL FEMORAL EPIPHYSIS,

Yale Univ., New Haven, Conn. School of

J. L. Kelsey, and K. J. Keggi. Yale J Biol Med. Vol 44, No 3, p 274-285. 1971.

Identifiers: Epidemiological studies, *Epiphysis, *Fluorides, Human diseases, *Water treatment,

An epidemiological study of slipped capital femoral epiphysis indicated that FI (fluorides) in drinking water had no effect on the frequency of this disease, either in Connecticut, where some communities had artificially fluoridated water supof 1 ppm Fl, or in the Southwestern part of the USA, where some localities had Fl levels of 2 ppm or higher in their water supplies. These findings in no way invalidate results of studies showing that fluorides in drinking water do protect against other diseases.—Copyright 1972, Biological Abstracts, Inc. W73-03071

HEALTH RELATED PROBLEMS IN ARID

Contribution No. 14, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Arizona State University, Tempe, April 21-24, 1971. M. L. Riedesel, editor. 71 p.

Descriptors: *Public health, *Southwest U. S. Arid lands, Water resources development, Limiting factors, *Environmental effects, Civil engineering, Social aspects, Water pollution, Water quality, Waste treatment, Optimum development plans, Water resources, Attitudes, Urbanization, Human resources, "Water treatment.

The purpose of the symposium, presented at the 47th annual meeting of the Southwestern and

Rocky Mountain Division of the American Association for the Advancement of Science, was to bring together eminent physiologists, engineers, physicians and sociologists who have been concerned with various aspects of the welfare of arid land inhabitants. Delivery of health care in a modern society emphasizes prevention rather than cure of ills. Engineers, in collaboration with physi-cians, and sociologists must insure that stress of our environment is well within our tolerance for strains. Nine papers which deal with physical fit-ness, respiratory ailments, physiology, municipal-agriculture-industry wastes with limited water resources, and current health services to the resources, and current heating services to the sparce populations in the southwestern United States are presented. (See W73-03127 thru W73-03129) (Black-Arizona) W73-03126

MUNICIPAL AND INDUSTRIAL WASTE WITH

LIMITED WATER RESOURCES, Hill, Ingman, Chase and Co., Seattle, Wash. C. C. Patterson.

In: Health Related Problems in Arid Lands, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Arizona State University, Tempe, April 21-24, 1971. M. L. Riedesel, editor. p 21-36. 18 fig.

Descriptors: "Waste water treatment, "Water quality, "Biochemical oxygen demand, "Chemical oxygen demand, "Dissolved oxygen, "Nutrient removal, Water pollution control, Pollution abatement, Water analysis, Waste water (Pollution), Water pollution, Rivers, Rio Grande river, Trick-ling filters, Sewage effluents, Sampling.

Wastewater treatment is practiced for the purpose of avoiding or abating nuisance conditions in receiving streams. Treatment systems are essentially in two parts, namely, primary treatment and secondary treatment. The first method consists of physical treatment, the second is a biological process. A survey was made of the water quality of the Rio Grande downstream from Albuquerque, New Mexico. A series of sampling stations were established covering approximately 40 river miles south of the two treatment plants serving the city. Grab samples were collected and analyzed in October and November of 1970 for dissolved oxygen. (DO), biochemical oxygen demand (BOD), chemi-cal oxygen demand (COD), alkalinity, pH, total dissolved solids, nitrates, phosphates, Coliforms, Salmonella, and Shigella. Samples of the two treatment plant effluents were also tested and correlated with river water quality. Major interest was focused on the effect of BOD on the river. In addition to the results of these tests, a discussion of nutrient control of waste water is presented where treatment is aimed at the removal of N and P. (See also W73-03126) (Black-Arizona) W73-03127

AGRICULTURAL WASTES IN ARID ZONES, New Mexico State Univ., University Park. Dept. of Civil Engineering.
J. W. Hernandez.

In: Health Related Problems in Arid Lands, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Arizona State University, Tempe, April 21-24, 1971. M. L. Riedesel, editor, p 37-43, 1 tab, 8 ref.

Descriptors: *Farm wastes, *Domestic wastes, Water pollution, Water pollution sources, *Water quality, Waste water (Pollution), *Consumptive use, "Economic efficiency, "Environmental ef-fects, Ethics, Agriculture, Drainage water, Irriga-tion water, Arid lands, Return flow, Feed lots, Cattle, Poisons, Economics, Political aspects, Social aspects, Irrigation practices, Pesticides.

Three current agricultural waste disposal problems Three current agricultural waste disposal proteins are common to much of the arid and semiarid regions of the United States, namely, return flows from irrigation, cattle feed-lot wastes and economic poisons. Characteristics of each are given and discussed. Regulation of existing irrigation projects by the imposition of water quality standards is unlikely in arid regions. As long as the attitude prevails that unused water is wasted and that it is in the national interest to make arid lands productive through irrigation, there will be con-tinued pressure to import additional water supplies for arid-land irrigation. (See also W73-03126) (Black-Arizona) W73-03128

DISCUSSION OF WASTE DISPOSAL IN ARID

LANDS, Arizona State Univ., Tempe. Dept. of Civil Engineering.

J. W. Klock.

In: Health Related Problems in Arid Lands Committee on Desert and Arid Zone Research Symposium, Arizona State University, Tempe, April 21-24, 1971, M. L. Riedesel, editor, p 45-46.

Descriptors: Nutrients, *Nutrient removal, *Optimum development plans, "Water reuse, Water resources, Water resources development, Waste treatment, "Domestic wastes, Water pollution, treatment, "Domestic wastes, water pointion, water pollution sources, Water quality, Waste water (Pollution), "Consumptive use, Economic efficiency, Ethics, "Arid lands, Social aspects, Agriculture, Economics, Attitudes, Optimization, Public health, "Waste disposal.

The many advantages of waste water reuse in arid regions can only be realized when the characteristics of wastes and waste treatment are understood. Of the three elemental ingredients, carbon, nitrogen and phosphorous, only carbon is lost in significant quantities, principally as carbon dioxide, leaving the water enriched in nitrogen and phosphorous. Nutrient removal is vital to prevent pollution in water-rich areas, but in arid regions, rather than being unwanted byproducts, both the water and the contained waste-derived nutrients are often badly needed. Overly conservative attitudes that result in the unnecessary banning of these waters must be set aside. The concept of optimization is fundamental to all waste treatment processes and their environs, and the requirements for any such system must maximize the benefit derived at a minimum exposure to hazard, expenditure of resources, and environmental al-terations. (See also W73-03126) (Black-Arizona) W73-03129

BIOLOGIC PARAMETERS IN WATER TRANS-MISSION OF VIRUSES, New Hampshire Univ., Durham, Dept. of

Microbiology.
For primary bibliographic entry see Field 05A.
W73-03173

DETECTION OF VIRUSES IN WATER: A REVIEW OF METHODS AND APPLICATION, Gulf Coast Water Hygiene Lab., Dauphin Island, Ala.

For primary bibliographic entry see Field 05A. W73-03174

PROGRESS IN THE DEVELOPMENT OF AN APPARATUS FOR CONCENTRATION VIRUSES FROM LARGE VOLUMES

WATER, Baylor Coll. of Medicine, Houston, Tex. Dept. of Virology and Epidemiology.

For primary bibliographic entry see Field 05A.

W73-03175

CONCENTR ULTRAFILT PORT ON TO SYSTEM, Gulf South Public Health For primary b W73-03176

LABORATO OF POLIO WASTEWAT California U For primary b W73-03178

THE ANTII POLYHALO RESINS, Kansas State S. L. Taylor. MS Thesis, 1 A-028-KAN (

Descriptors: Potable water cides, *Water Identifiers: *5 cus fecalis, S

Strongly basis ammonium or sulfate forms plex with the plex has rema gram column 5th power Esthe 9th power efficiency. Th above those a were not fil through the co the antibacter ing the damag antibacterial against four o to the 6th pow 1.1 x 10 to the monas aeru concentration and 10 to the 5 W73-03187

THE USE (RESIN-TRIIO TIVATE VIRI s State N. A-H. Hasse M Sc Thesis, 028-KAN (4)

Descriptors: 4 water, Bacter cides, *Water Identifiers: *7 Polyoma viru megaterium Q

Strong base as ble insoluble c against five dil tive organisms on capsulated and RNA vir showed that th ty to kill 8 x 1 capsulated Str 5th power cell results obtaine

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Water Quality Control-Group 5G

CONCENTRATION OF VIRUSES BY OSMOTIC ULTRAFILTRATION: A PRELIMINARY RE-PORT ON THE DEVELOPMENT OF A MODEL SYSTEM. Gulf South Research Inst., New Orleans, La.

Public Health Science Div. ary bibliographic entry see Field 05A.

For primary W73-03176

LABORATORY STUDIES ON THE SURVIVAL OF POLIOVIRUS IN ALGAL-BACTERIAL WASTEWATER TREATMENT SYSTEMS. California Univ., Berkeley. School of Public Health

ary bibliographic entry see Field 05D.

THE ANTIBACTERIAL CAPABILITIES OF POLYHALOGENATED ION EXCHANGE

RESINS, Kansas State Univ., Manhattan. Div. of Biology. S. L. Taylor. MS Thesis, 1970, 23 p, 2 fig, 6 tab, 15 ref. OWRR A-028-KAN (3).

Descriptors: *E. coli, Anion, exchange, Resins, Potable water, Ion exchange, Bacteria, *Bactericides, *Water treatment.

Identifiers: *Salmonella typhimurium, Streptococcus fecalis, Staphylococcus aureus, Pseudomonas

Strongly basic anion exchange resins (quarternary am or tertiary sulfonium types, chloride or sulfate forms) form a stable, water-insoluble com-plex with the triiodide 13 (-) ion. The resin-I3 complex has remarkable antibacterial properties. A 3.8 gram column of the complex kills 3.0 x 10 to the 5th power Escherichia coli per ml and 1.14 x 10 to the 9th power total without any noticeable loss of efficiency. These bacterial concentrations are far above those allowable in potable water. Bacteria were not filtered from the water by passing gh the column. This was demonstrated using 14C-labeled bacteria. The irreversible nature of the antibacterial action was revealed when washing the damaged cells did not restore viability. The against four other organisms ranged from 100 x 10 to the 6th power Salmonella typhimurium per ml to 1.1 x 10 to the 4th power Streptococcus fecalis per ml killed. Staphylococcus aureus and Pseudomonas aeruginosa were also tested and killed at concentrations of 1.8 x 10 to the 4th power and 1.3 and 10 to the 5th power per ml, respectively. W73-03187

THE USE OF QUATERNARY AMMONIUM RESIN-TRIIODIDE COMPLEX TO INAC-TIVATE VIRUS AND SELECTED BACTERIA, Kansas State Univ., Manhattan. Div. of Biology. N. A-H. Hassouna. M Sc Thesis, 1971, 22 p, 4 tab, 18 ref. OWRR A-

Descriptors: *Anion exchange, *Resins, Potable water, Bacteria, Viruses, *Bactericides, *Viricides, *Water treatment.

Identifiers: "Triiodide, DNA virus, RNA virus, Polyoma virus, Streptococcus bovis, Bacillus megaterium QM, Bacillus cereus.

Strong base anion exchange resins form very sta-ble insoluble complexes with triiodide. This resin has great antibacterial capabilities against five different Gran positive and Gran negative organisms. The effect of this resin-I3 complex on capsulated and sporulated bacteria, also DNA and RNA viruses was investigated. The results showed that this resin-I3 complex has the capabilishowed that its results complete has the capability to kill 8×10 to the 5th power cell/ml of an encapsulated Streptococcus bovis and 1.0×10 to the 5th power cell/ml of a noncapsulated strain. The lts obtained with the sporulated bacteria were

not conclusive. The complex killed 50% of the pure spore suspension of Bacillus megaterium QM and 90-99.9% of spore forming Bacillus cereus. As much as 2.0 x 10 to the 4th power particles/ml of the RNA virus (Newcastle disease virus, NDV) were killed. With the DNA virus (polyoma virus) the fill was 95% when a concentrated virus in Eales's medium (6 x 10 to the 7th power /ml) was passed through a 3.8 cm column. When the virus (8 x 10 to the 8th power particles/ml.) was diluted 10 to the 3rd power times in a second experiment and passed through a 30 gm column, 3 x 10 to the 5th power particles/ml. were killed. The use of 3Hthymidine labeled polyoma virus showed that the virus was not filtered out by the column, but passed through, and emerged in nonviable form. It was also found that the column eluent has no harmful effect on the monolayer of mouse embryo tissue culture or the growth of monolayers of rabbit kidney cells. (Hassouna-KWRRI) W71-03188

QUALITY OF THE WATER USED FOR HUMAN CONSUMPTION (IN FRENCH), For primary bibliographic entry see Field 05G. W73-03204

5G. Water Quality Control

THE USE OF AQUATIC PLANTS IN THE REHABILITATION OF ACID POLLUTED

STREAMS, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. R. H. Wagner.

Available from the National Technical Information Service as PB-213 507, \$3.00 in paper copy, \$0.95 in microfiche. Research Project Technical Completion Report, June 1972, 9 p.

Descriptors: *Acidic water, *Pollution abatement, *Aquatic plants, Plant physiology, Hydrogen ion concentration, Phosphorus.
Identifiers: *Eleocharis acicularis.

The general ecology of Eleocharis acicularis (L.) R. and S. was studied with special emphasis placed on its relation to acid polluted streams. Distribution and vigor appear to be related to the pH and P levels of the water and substrate: in laboratory experiments, growth was optimal in the pH range of 3.6 to 5.0 and inversely proportional to P concentration. Other mineral factors appear to be unrelated to E. acicularis distribution. The adult plant also has a broad temperature amplitude for its is able to grow at 32 C and overwinter in a vegetative state at 4 C. Reciprocal transplants and microscopic examination of the culm confirmed the identity of the sterile-aquatic form and the fertile-terrestrial form. Under proper conditions of moisture or cold treatment, the seeds will germinate readily with a germination rate of 80%. Internally, the seed is simple and relatively undifferentiated. The mode of germination closely resembles that of E. palustris. The abundance of aufwuchs and certain insect larvae point to the importance of E. acicularis in providing suitable substrate and shelter for other organisms. W73-02611

A COMPARISON OF PUBLIC AND RESOURCE ADMINISTRATOR VISUAL PERCEPTIONS OF AN OUTDOOR WATER-BASED RECREATION

AREA, Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. For primary bibliographic entry see Field 06B. W73-02612

IMPROVING WATER QUALITY BY REMOVAL IMPROVING WATER QUALITY BY REMOVAL OF PESTICIDE POLLUTANTS WITH AQUATIC PLANTS, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Plant Pathology and

Physiology. S. W. Bingham

Available from the National Technical Information Service as PB-213 495, \$3.00 in paper copy, \$0.95 in microfiche. Virginia Water Resources Research Center Completion Report, August 1972. 70 p, \$2 fig. OWRR A-033-VA (2).

Descriptors: "Pesticides, "Aquatic plants, "Algae, "Pesticide removal, Pesticide toxicity. "Path of pollutants, Scenedesmus, 2-4-D, Hydrogen ion concentration, Herbicides, "Water quality control. Identifiers: "Pesticide degradation, Pesticide pol-Intante

Several species of algae and aquatic vascular plants were evaluated for effectiveness in removing pesticides from water. Pesticides with 14Clabel were utilized to determine uptake and degradation. It is evident that aquatic algae and vascular plants do remove pesticide residues from water. This might help explain why herbicide residues have not accumulated in surface water to dangerous levels. In general, submerged aquatic plants were not as effective in removing the herbicides as emerged species. This might be explained by the fact that the emerged species transpire considerable amounts of water through their leaves; the plant behaving much like a wick. The various algae tested were not equally effective in sorbing the pesticides. Scenedesmus was particularly effective in this respect. The pH of the suspendi medium proved to be important in the case of 2,4-D. This is probably related to the ionization constant of the 2,4-D molecule (pka about 3). It was demonstrated that once sorbed, these pesticides were metabolized by the various aquatic vascular plants and algae. It should also be noted that the pesticides generally were not toxic to the plants or algae at residue levels normally encountered in surface waters. W73-02621

WATER RESOURCES MANAGEMENT IN DELAWARE, Delaware Univ., Newark. Water Resources For primary bibliographic entry see Field 06B.

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1972. Maine Univ., Bangor. Water Resources Center. For primary bibliographic entry see Field 09A. W73-02630

W73-02622

CONTROL OF MERCURY POLLUTION IN SEDIMENTS Robert S. Kerr Water Research Center, Ada,

Copy available from GPO Sup Doc as EP 1.23/2:72-043, \$0.75; microfiche from NTIS as PB-213 771, \$0.95. Environmental Protection Agency, Office of Research and Monitoring Environmental Protection Technology Series Report EPA-R2-72-043, September 1972. 55 p, 2 fig, 13 tab, 7 ref, ap-

Descriptors: *Water pollution control, *Mercury, *Sediments, *Sedimentation, *Industrial wastes, *Surface waters, Investigations, Sampling, Chemical analysis, Bottom sediments, Rivers, Bays, Streams, Water pollution sources, Analytical techniques, Iron, Methodology. Identifiers: Mercury recovery, Iron overlay (Sediments). Hypochlorite leach.

Group 5G-Water Quality Control

Methods are described for controlling pollution from mercury-laden sediment deposits on the bottom of streams and lakes. Five sediment samples tom of streams and lakes. Five sediment samples containing from 6 ppm to 500 ppm mercury were investigated. Two samples were taken from the St. Clair River (Mich) below the outfall of a chloroal-kali plant; one sample from the Detroit River (Mich) below a chloroalkali plant; one sample from a stream which empties into the San Francisco Bay; and one sample from an industrial holding pond used for disposing of waste from a chloroalkali plant. A variety of methods for recovering the mercury values from dredeed sedirecovering the mercury values from dredged sedirecovering the mercury vanues from dredged sedi-ments were explored. Density fractionation, parti-cle size fractionation, flotation, roasting and leaching were the methods studied. Roasting and chemical leaching afford the greatest promise for inexpensive removal and recovery of the mercury. The use of an iron overlay in the form of crush automobile bodies topped with sand could be an inexpensive and effective method of isolating mercury-containing sediments from a water overlayer.

An important attraction of using iron as an overlay is its ability to reduce methylmercury ions as well as mercuric ions to elemental mercury. (Woodard-W73-02632

EVALUATION OF POTABLE WATER

STORAGE TANKS, Army Mobility Equipment Research and Develop-ment Center, Fort Belvoir, Va. Sanitary Sciences

D. C. Lindsten. Available from NTIS, Springfield, Va. 22151 as

AD-743 184; \$3.00 paper copy; \$0.95 microfiche. Report 2026, March, 1972. 40 p, 2 fig, 6 tab, 5 ap-

Descriptors: *Water storage, *Storage tanks, *Potable water, *Plastics, *Research and development, Testing procedures, Evaluation, Synthetic rubber, Odor, Taste.
Identifiers: Moble water tanks.

The stability of potable water in long-term contact with new materials of various sized fabric waterstorage tanks and the effect of extended water storage on these materials were investigated. Residual chlorine lasted only 1 to 16 days in water stored in neoprene and styrene butadiene rubber (SBR) tanks. In vinyl tanks, the chlorine lasted as long as 31 days. Residual chlorine lasted at least 15 months in water stored in a polyethylene Combination Water Container and Commode (CWCC), and at least 23 months in a Sanitation Kit Metal Container (SKMC). A rubbery taste and odor developed in 1 to 6 weeks in water stored in neoprene and SBR tanks. A medicinal taste and odor developed in 1 month to 1 year in water stored in a vinyl tank. Water stored in the CWCC stored in a vinyl tank. Water stored in the CWCC and the SKMC showed a chlorinous taste and odor, however, the water was acceptable for drinking. Water stored in neoprene tanks developed an unsatisfactory high level of color. Water stored in SBR and vinyl tanks, in the CWCC, and in the SKMC did not develop a significant amount of color. Neoprene, SBR, and vinyl tanks were subject to fungal attack; how-ever, fabric disintegration did not occur. Neoprene tank in the 50- and 100-gallon sizes survived a 1-ft free drop without rupture. During the overall time period (2 years), no tank failures took place. (Woodard-USGS) W73-02656

GEOLOGY, SOILS, AND HYDROGEOLOGY OF VOLO BOG AND VICINITY, ILLINOIS. Illinois State Geological Survey, Urbana. For primary bibliographic entry see Field 02H. W73-02657

INTEGRATED MANAGEMENT OF QUANTITY

INTEGRATED MANAGEMENT OF QUANTITY AND QUALITY OF URBAN WATER RESOURCES, Texas A and M Univ., College Station. Dept. of Industrial Engineering.
C. S. Shih, and W. L. Meier, Jr.
Water Resources Bulletin, American Water Resources Association, Vol 8, No5, p1006-1017,October, 1972. 7 fig. 5 tab, 25 equa, 7 ref.

Descriptors: "Water quality, "Water quantity, Water pollution control, "Management, Methodology, Water treatment, Water treatment, Costs, "Besefits, "Dynamic programming, River basins, "Low flow augmentation, Planning, Optimization, Economics, Biochemical oxygen demand, Dissolved oxygen, Wastes, Computer programs, Mathematical models, Systems analysis, "Optimal development plans, Cities. Identifiers: "Economic trade-offs, Receiving stream, Pollutors. stream, Pollutors

The existence of two separate agencies for water pollution control and water supply does not necessarily enhance the possibilities of effective water quality management. The optimal management of river systems can be realized only by increasing the amount of interaction between such agencies. the amount of interaction between such agencies. Presented is a total water quality-quantity management approach which considers the costs of water pollution control and water treatment, the benefits of water-based activities, and the trade-off between low flow augmentation and water quality improvement. The analytical framework is based improvement. It analytical framework is based on the decomposition approach of dynamic programming within which the optimal management plans are developed. An illustrative example with complete solution is presented. Integration between water resource users and waste dischargers is considered in the method, which is gers is considered in the method, which is designed to enable both agencies to study the mu-tual effects of their decisions in search for an equitable management policy. The flexible procedures developed may offer an adaptable tool for: (1) assessment of economic trade-off relation-ships involved in comprehensive river basin management; (2) devising the basis of equitable tree structures for a river subscript, and establishment of quality control and reservoir operational policies. (Bell-Cornell) W73-02666

BIBLIOGRAPHY ON HANDLING, CONTROL AND MONITORING OF TRITIUM (DEC. 1968-

JAN. 1972), Mound Lab., Miamisburg, Ohio. For primary bibliographic entry see Field 05B. W73-02708

WASTE RADIOACTIVE LYONS, KANSAS, (FINAL ENVIRONMENTAL IMPACT STATEMENT).
Atomic Energy Commission, Washington, D.C. For primary bibliographic entry see Field 05C.

W73-02721

APPLICATION OF CF252 TO THE DETECTION OF HEAVY METALS FOR POLLUTION CON-

TROL, Gulf Radiation Technology, San Diego, Calif. For primary bibliographic entry see Field 05A. W73-02738

EPA, ENVIRONMENTAL LEGISLATION AND

Environmental Protection Agency, Washington, D.C

J. A. Lieberman.

J. A. Lieberman.
Transactions available from American Nuclear Society, Inc., 244 E Ogden, Hinsdale, Ill. 60521. \$25,00. In: Transactions of American Nuclear Society, 1972 Annual Meeting, June 18-22, 1972, Las Vegas, Nevada, Vol 15, No 1, p 73, 1972.

Descriptors: "Administrative agencies, "Legal aspects, "Legislation, "Air pollution, Water pollution, "Water pollution control, Water quality control, Environmental control, Fenvironmental control, Permits, Licenses. Identifiers: "Environmental Protection Agency.

The responsibilities of EPA that affect energy are described. EPA's authority in the air, water, and radiation areas and some of the problems and benefits that are involved in trying to ensure that EPA's various areas of authority are exercised in such a way as to adequately protect the environment are discussed. The problems and advantages of relating EPA's authorities to each other and overall environmental protection are best illustrated in the energy area. Under the Clean Air Act, EPA was required to set standards among others. onsibilities of EPA that affect energy are trated in the energy area. Under the Clean Air Act, EPA was required to set standards among others for (a) national ambient air quality, (b) hazardous air pollutants, and (c) new stationary sources. These standards and the means of enforcing the standards will be briefly considered. Under the Federal Water Pollution Control Act, the States have primary responsibility for setting water quality standards and enforcing them, EPA's role in aproving and assisting in the enforcement of these standards are discussed. The Rivers and Harbors Act of 1899 prohibits discharges of refuse into navigable waters of the U.S. without a permit. The status of EPA's Permit Program and enforcement measures taken under the Act will be considered. (Houser-ORNL)

THE DECAY AND STABILITY OF INTERNAL WAVE MODES IN A MULTISHEETED THER-

MOCLINE, Reading Univ. (England). Dept. of Geophysics. B. Johns, and M. J. Cross. Journal of Marine Research, Vol 28, No 2, p 215-224, 1970. 3 fig. 3 ref.

Descriptors: *Thermocline, *Thermal stratifica-tion, *Stability, Mixing, *Waves (Water), Stratifi-cation, Density, Turbulence, Surface waters, Mathematical models, Heated water, Energy dissipation.
Identifiers: *Internal wave modes, Decay.

Internal wave motions are considered in a therinternal wave motions are considered in a thermocline that consists of this sheets across which there are abrupt changes in the density. These sheets are separated by homogeneous layers of water in which there is turbulent mixing. Investigations have been undertaken to determine the dependence of both the rate of energy dissipation and the dramping lethility upon the number of and the dynamical stability upon the number of sheets in the thermocline. Conclusions are: (1) the sheets in the thermocline. Conclusions are: (1) the higher-order internal wave modes are so heavily damped that they cannot persist as free oscillations for more than a few cycles; (2) the dynamical stability of the internal modes is greatly increased by an increase in the number of sheets in the thermocline; (3) for a specified number of sheets, the higher modes are less stable than the lower. (Oleszkiewicz-Vanderbilt)

A METHOD FOR CALCULATING THE SIZE OF COOLING TOWER PLUMES, Royal Netherlands Meteorological Inst., De Bilt. H. R. A. Wessels, and J. A. Wisse. Atmospheric Environment, Vol 5, No 9, p 743-750, September 1971. 4 fig, 1 tab, 8 ref.

Descriptors: *Cooling towers, *Heat, *Dispersion, Mathematical models, *Thermal pollution, Air pollution, Temperature, Powerplants, Thermal powerplants, Enthalpy, Meteorological data. Identifiers: *Cooling tower plumes, *Plumes, Netherland, Heat exchange.

and commission from a wet cooling tower consists of saturated and heated air. The plume of the tower is described in terms of the dispersion of the enthal-py gained by the air in the tower. A nomogram is developed to determine the learning the eveloped to determine the length of the visible

part of the plum plume reaches the of the Pasquill-source height. T strated for a fict cooling tower us winter season at kiewicz-Vanderb W73-02763

SOUNDING TI

New Scientist, V

Descriptors: *N reactors, *Coolin mal pollution, W Heated water, C vironmental effect Identifiers: *Directors

A nuclear power heat exchangers one large cooling into the air, is on for high-temper beginning to mat the reactor core raise steam in co these gases direc lower capital cos designs for direct in the United K France and the U advantages of thi pollution may be engineering. Hea at higher temper water is required smaller in size kiewicz-Vanderb W73-02764

FUEL CYCLES REACTOR, Argonne Nationa S. Lawroski. al Engine 23-25, May 1972.

Descriptors: *N reactors, *Nucle Reactors, Power Identifiers: *Liq *Nuclear fuel cyc

The liquid metal may not be a combut already the proved fuel cycle fact that both L fossil fuel plant when pollution c processes, as this way to reduce th cles and nuclear by speculations of cle of fuel. Other such as techniqu fuel can be made kiewicz-Vanderb W73-02765

ELECTRICAL VIRONMENTAL THE FUTURE. For primary bibli W73-02768

Water Quality Control—Group 5G

part of the plume. The conditions for which the plume reaches the ground are given in dependence of the Pasquill-stability-class and the effective source height. This theoretical model is demon-strated for a fictitious 500 MW natural draft type cooling tower using meteorological data of one winter season at De Bilt, The Netherlands. (Olesz-tiewicz-V anderbilt) W73-02763

SOUNDING THE ALL-IN-ONE NUCLEAR DRUM.

New Scientist, Vol 46, No 696, p 69, April 9, 1970.

2 fig.

Descriptors: "Nuclear powerplants, "Nuclear reactors, "Cooling, Thermal powerplants, "Ther-mal pollution, Water pollution, Reactors, Heat, Heated water, Cooling towers, Generators, En-vironmental effects.

Identifiers: *Direct cycle reactors, *Helium cool-

A nuclear power station - reactor and shielding, heat exchangers and turbines - all contained within one large cooling tower, dissipating the waste heat into the air, is one idea emerging now that designs for high-temperature, gas-cooled reactors are beginning to materialize. The prime attraction of eliminating the boilers and heat exchangers, where the reactor core cooliness services un its heat to eliminating the boilers and neat exchangers, where the reactor core cooling-gas gives up its heat to raise steam in conventional AGRs, and expanding these gases directly through gas turbines, 'lies in lower capital costs for the power station. Compact designs for direct-cycle plants have been drawn up in the United Kingdom, Germany, Switzerland, France and the United States. The environmental edvantages of this solution are numerous. Thermal edvantages of this solution are numerous. advantages of this solution are numerous. Thermal pollution may be altogether avoided with careful gineering. Heat is rejected from the direct cycle engineering, rieat is rejected which means less cooling at higher temperature which means less cooling water is required. Such plants would also be much smaller in size than ordinary plants. (Olesz-kiewicz-Vanderbilt)

FUEL CYCLES AND THE FAST BREEDER REACTOR, Argonne National Lab., Ill. S. Lawroski.

Chemical Engineering Progress, Vol 68, No 5, p 23-25, May 1972. 2 photos.

Descriptors: *Nuclear powerplants, Reactors, "Nuclear engineering, "Fuels, Cooling, Reactors, Powerplants, Breeder reactors, Costs. Identifiers: "Liquid metal fast breeder reactor, *Nuclear fuel cycle.

The liquid metal fast breeder reactor (LMFBR) may not be a commercial reality until the mid-80's, but already the scientists are looking at an improved fuel cycle. The reason for this search is the fact that both Light Water Reactors (LWR) and fossil fuel plants will have lower capital costs when pollution control is taken into account. The discussion is concentrated on fuel recovery processes, as this seems to be the most promising way to reduce the capital costs. Types of fuel cycles and nuclear safeguards are discussed followed by speculations on a possibility of a remote recy-cle of fuel. Other elements in the LMFBR's design such as techniques to fabricate fuel and type of fuel can be made more economical as well. (Oleszkiewicz-Vanderbilt) W73-02765

ELECTRICAL ENERGY NEEDS AND EN-VIRONMENTAL PROBLEMS, NOW AND IN THE FUTURE.
For primary bibliographic entry see Field 05C.

THERMAL STRATIFICATION AND THER-MOCLINE CONTROL IN STORAGE RESER-

WOLLING
VOIRS,
Metropolitan Water Board, London (England).
For primary bibliographic entry see Field 05B.
W73-02777

IN THAMES VALLEY RESERVOIRS, Metropolitan Water Board, London (England). For primary bibliographic entry see Pield 03B. W73-02778 CONTROL OF THERMAL STRATIFICATION

HANDLING HOT WATER, WITH A PAYOFF, State Univ. of New York, Albany. Atmospheric Sciences Research Center. R. Stewart, and P. H. Carrigan, Jr. The Conservationist, Vol 25, No 3, p 16-20, December-January, 1970-71. 4 photos.

Descriptors: *Beneficial use. *Heated water. Descriptors: "Beneficial use, "Heated water, Economics, "Heat, "Thermal pollution, Thermal powerplants, Powerplants, Water pollution, Tem-perature, Agriculture, Fish farming, Catfishes, Cooling, Distillation. Identifiers: "Waste heat uses, "Waste heat,

Geothermal energy.

A summary is presented of the conference: Beneficial Uses of Thermal Discharge sponsored by the New York State Department of Environ ment. Some thirteen papers were presented at the meeting. The beneficial use of a thermal discharge may be divided into two categories: (1) direct use of the discharge by an agency independent of the utility of (2) an integrated coupling of the power plant to a closed cycle operation which continuously uses the same water and returns it to the utility. Both agriculture and mariculture, for examle could be categorized under category one ple could be categorized under category being able to use the discharged heat directly. As the conference had an international character, examples are cited from Iceland (goothermal heat) and Scotland as well as from catfish farming areas in this country. Urban and industrial applications are also discussed. (Oleszkiewicz - Vanderbilt) W73-02780

STATIONARY HEAT TRANSPORT BY PLANE GROUNDWATER MOVEMENT IN A THIN OR A THICK LAYER, Technische Hogeschool, Delft (Netherlands).

Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W73-02820

COMPREHENSIVE SURVEY OF ELK RIVER BASIN, VOLUME II, ECONOMIC BASE STU-

West Virginia Dept. of Natural Resources, Char-leston. Div. of Water Resources. For primary bibliographic entry see Field 06D. 73-02860

CLEANING WATER MAINS WITH FOAM PLUGS-EXPERIENCE AT WASHINGTON, D.

District of Columbia Dept. of Sanitary Engineering, Washington. Bureau of Water Services.

Presented at American Water Works Association ual Conference, Denver, Colorado, June 15, 1971, 7 p. 2 ref.

Descriptors: *Distribution systems, *Pipelines, *Pumping, *Cleaning, *Scaling, *District of Columbia, Preventive maintenance, Operation and maintenance, Maintenance costs, Water supply, Municipal water, Contamination, Calcium carbonate, Iron oxides.

Identifiers: *Water main cleaning, Water distribu-tion systems, Fire plugs, Pipe scale.

The District of Columbia has over 1,300 miles of water mains ranging from 2 inches to 78 inches in diameter, some of which are about 120 years old. About 600 miles of 4 inch to 8 inch mains were installed before 1942 and are unlined and badly tuberculated. Although a cement lining program has been underway, there are still many complaints of muddy water. In July of 1969, for example, there were 2,400 complaints. It became obvious that a cleaning program was needed. Various methods were researched, but were discarded in favor of a system that would use the hydrants as launch and recovery portals for the cleaning medium. The principal factors for using the hydrants were economics, public relations, and convenience to traffic and pedestrians. A soft object was desired for cleaning because a hard object would break the tubercules and aggravate the problem. From a literature search, the use of soft foam was studied and accepted. In the testing program, 78,000 feet and accepted. In the testing program, 78,000 feet of 8-inch main were cleaned without a single com-plaint. The procedure is quite simple, but detailed. First, the area's distribution system is studied, noting length of pipe to be cleaned, location of entry and recovery hydrants, and the type and entry and recovery hydrants, and the type and number of valves. A field survey is made to see who will be affected and if temporary water lines will need to be supplied. All valves are checked and, if defective, repaired. Notices are sent out to the people affected to notify them of the shut down. All valves which can be closed down be-forehand are closed the night before the cleaning. Foam plugs are inserted through fire hydrants under water pressure and propelled approximately 4,000 feet before removal. Cleaning costs average \$103,1000 ft. (Poertner) W73-02862

THURSTON COUNTY, A COMPREHENSIVE WATER AND SEWERAGE PLAN, VOLUME II, WATER PLAN. Cornell, Howland, Hayes and Merryfield, Seattle,

For primary bibliographic entry see Field 06D. W73-02865

PETROLEUM HYDROCARBONS AND THE SEA, Washington State Dept. of Ecology, Olympia. Of-

fice of Technical Services.
For primary bibliographic entry see Field 05C.

THE CODORUS CREEK WASTEWATER MANAGEMENT STUDY, SUMMARY REPORT AND CONCLUSIONS. Army Engineer District, Baltimore, Md.

August 1972. 86 p, 31 fig, 14 tab.

Descriptors: "Watershed management, 'Baseline studies, Water quality control, Waste water treatment, 'Planning, Pollution abatement, Streams, Waste water disposal, Flood control, 'Pennsylvania, Sewage districts, Tertiary treatment, Cost analysis, Contamination, Public health, Water demand, Forecasting, Sewage treatment, River basins, 'Water quality standards.

Identifiers: 'Codorus Creek (Penn). Descriptors: *Watershed management, *Baseline

The Codorus Creek Basin, with an area of 280 square miles and a population of 188,000, is located in southeastern Pennsylvania. It has a severe pollution problem. With a tributary population of 323,000, predicted by the year 2,000, the stream will not be able to meet water demands, even by 1985, unless proper corrective action is even by 1985, unless proper corrective action is taken. With streamflow as much as 75 percent wastewater, the stream has severe problems of nutrients, coliform, high BOD, low DO, heavy metals, color, algae and temperature. The nickname of the stream is given as 'The Inky-Stinky Codorus'. The study gives five plans for correcting the problems of the Creek, depending

Group 5G-Water Quality Control

on the goals of the people. Use of the Creek as a waste disposal depot, for example, requires a dif-ferent plan of action than does the restoration of the Creek to a crystal clear stream suitable for recreational use. Costs given for alternative plans range from an annual cost of \$11 million annually for the most expensive plan, which meets very high water quality standards. (Poertner) W73-02869

CODORUS CREEK WATER QUALITY IN-VESTIGATION REPORT,
Environmental Protection Agency, Philadelphia,

Pa. Region III. E. A. Kaeufer.

March 1972, 114 p. 11 tab.

Descriptors: Water pollution, Surveys, *Data collections, Pollution abatement, Streams, Planning, *Pennsylvania, Waste water treatment, Waste water disposal, Water districts, Tertiary treatment, Public health, Sewage treatment, Industrial wastes, Environmental control, Waste assimila-tive capacity, *Water quality standards. Identifiers: *Codorus Creek (Penn).

The Codorus Creek is grossly polluted by industrial, agricultural and municipal discharges. This Water Quality Study was initiated to determine ex-isting conditions of the Codorus Creek Watershed in order to establish a Wastewater Management Plan. Five objectives are: (1) establish a base-line record of water quality, (2) determine characteristics of natural purification, (3) determine pat-terns of pollution downstream from waste discharges, (4) estimate waste assimilation capabilities of Codorus Creek and its tributaries, and (5) estimate the reductions in waste loads necessary to meet water quality standards. Water quality was very poor in some areas, with toxic materials present. Nutrients concentrations were present in levels far above that needed for algae growth stimulation, and high bacteriological counts were found. Six municipal waste water treatment plants are on the Creek, all having secondary treatment. Forty industrial polluters, of which 22 discharge directly into the stream, were identified; the other 18 discharge to municipal treatment plants, the soil, or to the Creek. All seven wastewater discharges tested violate effluent standards established by the Pennsylvania Implementation Plan dated December 20, 1967. Bacteriological data suggest that treatment plant effluents are receiving inadequate chlorination or that in-dividual homes and livestock discharges are reaching the Creek. (Poertner) W73-02870

THE TRANSFER OF WATER RESEARCH OUT-PUT BY THE ENVIRONMENTAL PROTEC-TION AGENCY, Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 06B. W73-02879

ASSIMILATION OF A WASTEWATER TREAT-MENT PLANT EFFLUENT BY THE ASA CREEK-KASKASKIA RIVER SYSTEM, MOUL-TRIE COUNTY, ILLINOIS,

Illinois Univ., Urbana. Dept. of Zoology. For primary bibliographic entry see Field 05C.

BED-LOAD TRANSPORT IN MOUNTAIN Oregon State Univ., Corvallis. Dept. of Civil En-

gineering. For primary bibliographic entry see Field 02J. W73-02893

ADJUDICATION PROVISIONS UNDER THE ADJUDICATION PROVISIONS UNDER THE
1999 WATER CODE—SURVEY OF CASE LAW
AND PROPOSALS FOR LEGISLATIVE
AMENDMENT,
Oregon State Univ., Eugene. School of Law.
For primary bibliographic entry see Field 06E.

IMMEDIATE COST-EFFECTIVE ABATEMENT OF WATER POLLUTION FROM NAVY SHIPS. Naval Postgraduate School, Monterey, Calif.

Available from the National Technical Informa-tion Service as AD-741 117, \$9.00 in paper copy, \$0.95 in microfiche. Collective Misc. Thesis, March, 1972. 371 p, 164 ref, 4 append.

Descriptors: "Water pollution, "Oil spills, "Oil pollution, "Pollution abatement, Ships, Fuels, Control, Planning. Identifiers: "Cost effectiveness, Bilge, Fueling control, Spill cleanup, Oil containment, Oil recovery, United States Navy.

The U.S. Navy has made long-range plans for its attack on all aspects of pollution. A study group of twelve officer students at the Naval Postgraduate School, Monterey, California, investigated several aspects of these plans and evaluated alternative solutions for pollution abatement. The group also studied possible short-term measures to provide immediate solutions pending implementation of the long-range plans. Topics examined by the study group include (1) shipboard control of study group include (1) snipboard control of wastes, (2) toxicity and spreading of oil in seawater, (3) the vertical movement of oil in seawater and the aging of oils slicks, (4) characterization and treatment of bilge and ballast water, (5) oil spill characteristics and statistics, (6) reduction of oil spills during shipboard fuel movement evolution. tions, (7) analysis of the effects on oil spills of fuel policy changes and the addition of another fuel pier with the aid of a computer simulation model, plet with the aim of a computer simulation model, (8) a financial analysis of the containment and recovery of Navy oil spills, and (9) location and equipment for oil recovery teams in San Diego. (See W73-02902 thru W73-02910) (Settle-Wisconsin) W73-02901

SHIPBOARD CONTROL OF WASTES, Naval Postgraduate School, Monterey, Calif. G. A. Sanders, R. H. Stuhlman, and F. M.

In: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate School, p 15-101, March, 1972. 1 fig, 13 tab, 54 ref.

Descriptors: *Sewerage, *Ships, *Waste disposal, Waste treatment, Treatment facilities, Costs. Identifiers: *Sanitary sewage, On-ship treatment, Off-ship treatment.

The three basic ways of disposing of sanitary wastes generated aboard U.S. Navy ships are (1) treatment on-board and discharge into the environment, (2) hold on-board for discharge into open ment, (2) note on-board or discharge into open waters or off-ship receiving facilities, and (3) discharge directly into connections to off-ship facilities. Of the fourteen on-board treatment systems that have been tested and evaluated, none could satisfactorily meet Environmental Protec-tion Agency standards or satisfy the rigorous requirements of shipboard operations. The concept of a centralized holding tank leads to extensive and costly interior modification of existing ship structures and creates such potential problems as space limitations aboard the vessel and decreased operational range if fuel tanks are converted into holding tanks. Consequently, centralized holding systems should not be installed on existing vessels, although they may be desirable if designed as an integral part of new ships. Sanitary wastes can be efficiently and cheaply transferred to off-ship facilities through a Shipboard Sewage

Transfer Assembly unit. An examination of alternative off-ship receiving facilities suggests that the ultimate receiving facility should be pierside sewers. Until such sewers are constructed, barges or portable containers represent possible alternative receptacles. (See also W73-02901) (Settle-W73-02902

TOXICITY AND SPREADING OF OIL IN SEA WATER, Naval Postgraduate School, Monterey, Calif.

R. F. Barry.
In: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate School, p 102-147, March, 1972. 5 fig, 30 ref.

Descriptors: *Oil spills, *Toxicity, Oceans, Harbors, Coasts, Waste treatment.
Identifiers: *Ballast, *Bilge.

Studies conducted after two major open ocean oil spills indicate that the damage to the biota from these spills was slight. Environmental processes operate to rid the ocean of oil pollution in a relatively short period of time. Consequently, a dilute, readily degraded form of oil such as that found in bilge and ballast effluents need not be treated on board ship before discharge into the open ocean.
However, a study of dilute effluent discharges into
poorly flushed areas such as coastal or harbor waters indicates that discharge concentrations as low as 20 ppm may be toxic. Thus, bilge and bal-last discharges in confined waters can be harmful to the environment and should be transferred ashore for treatment. On-board treatment systems such as oil-water separators are thus not needed on the open ocean and not sufficient for in-port needs. An investigation of the spreading rates for in-port oil spills suggests that containment of an inport spill will become even more imperative as the Navy switches to distillate fuel. Distillate is more readily incorporated into the water column and can exert a more toxic effect than present fuels. (See also W73-02901) (Settle-Wisconsin) W73-02903

THE VERTICAL MOVEMENT OF OIL IN SEA-WATER AND THE AGING OF OIL SLICKS, Naval Postgraduate School, Monterey, Calif. R. S. Peterson.

In: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate School, p 148-179, March, 1972. 7 fig, 16 ref.

Descriptors: *Oil spills, *Emulsions, Waves (Water), Age. Identifiers: Mechanical mixing, Fire hoses, Herd-

Man-made turbulence generated by improper oil spill control techniques can drive significant amounts of oil deep into the water column where it may have serious toxic effects. A simulated fire hose directed on slicks of three common Navy fuel oils drove water emulsions to the bottom of a 68 cm deep test tank within 30 seconds. A fluorimeter monitoring of this emulsion over a three-day period indicated its relative stability. Of the natu ral turbulence-causing mechanisms, only whitecaps and breaking waves normally possess sufficient intensity to form stable oil-water emulsions. Since these natural mechanisms are not nor-mally found in harbors, allowing a slick to spread until gentle control measures were available may disperse smaller amounts of toxic oil throughout the water than immediately 'herding' an oil slick with fire hoses. A separate experiment with the aging of four Navy oils indicated that exposure to the atmosphere produces selective evaporation of oil constituents, thus permitting comparative age dating of slicks from gas chromatograph traces. This comparative dating is possible even though a number of factors prevent prediction of the absolute ratios of constituents to be expected at a given time. Such responsibility for (Settle-Wisconsin W73-02904

CHARACTERIZA BILGE AND BAL Naval Postgradua C. J. Hatleberg. In: Immediate Co Pollution From N School, p 180-210

Descriptors: *Oil water treatment, S Identifiers: *Bilge Rilge ballast trans

The problem of co the discharge of b was investigated. samples of bilge v San Diego and L water was found 100 ppm to 100 pe as found in the pi the bilges. Such of effluent standards untreated bilge wa acceptable proceed the bilge water in the oil concentra many oil removal were applicable trolling bilge wate biological degrade usage of a harbo systems such as iscarded as solut lation time, and fations. Biological most attractive te cost, rapid imple potential. (See als W73-02905

SPILL STATISTICS, Naval Postgradua J. M. Lacey. In: Immediate Co. Pollution From N School, p 211-231

Descriptors: *O Regression analys Identifiers: Clean

Between July 1, there were 593 oil The estimated co \$256,187. Sixty-fe sixty-seven perce the area of the Na were responsible the total spills a costs. Tenders highest average co regression betwee variable and the f pendent variable of oil spills of 9. \$4,066, and a cor data further indica cost tends to be costs for the next starts to sharply i high summer pers Regressions of co produced low co W73-02901) (Settle

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control-Group 5G

given time. Such dating may help in assigning esponsibility for oil spills. (See also W73-02901) Settle-Wisconsin)

HARACTERIZATION AND TREATMENT OF

HIGE AND BALLAST WATER, Vaval Postgraduate School, Monterey, Calif. 2. Hatleberg. n: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate school, p 180-210, March, 1972. 9 fig. 2 tab, 17 ref.

Descriptors: *Oil spills, *Water pollution, *Waste water treatment, Ships, Costs. dentifiers: *Bilge water, Biological degradation, Silge ballast transfer, Harbor donut.

The problem of controlling oil pollution created by the discharge of bilge water from U.S. Navy ships vas investigated. The investigation was based on amples of bilge water obtained from ships in the lan Diego and Long Beach harbors. Oil in bilge vater was found to range in concentration from 00 ppm to 100 percent and to be of the same type is found in the piping system of the spaces above he bilges. Such oil concentrations are above Navy ffluent standards; consequently, the pumping of intreated bilge water from any ship level is not an cceptable procedure. It is thus necessary to treat the bilge water in some manner in order to reduce he oil concentration prior to discharge. Of the nany oil removal methods examined, only three were applicable as temporary solutions for con-rolling bilge water pollution. These methods were principles which point to the semented were proportionally and the principles were provided as a second state of a harbor donut. Mechanical separation systems such as centrifuges and coalescers were liscarded as solutions because of their cost, instalation time, and failure to meet effluent specificaions. Biological degradation appeared to be the nost attractive temporary solution because of low cost, rapid implementation, and total oil removal cotential. (See also W73-02901) (Settle-Wisconsin) W73-02905

SPILL CHARACTERISTICS DIL. TATISTICS.

Naval Postgraduate School, Monterey, Calif.

. M. Lacey. n: Immediate Cost-Effective Abatement of Water

Pollution From Navy Ships, Naval Postgraduate School, p 211-231, March, 1972. 2 fig, 7 ref.

Descriptors: *Oil spills, *Costs, Frequency, Regression analysis, Statistics. dentifiers: Cleanup costs, San Diego Bay.

Setween July 1, 1966, and September 30, 1971, here were 593 oil spills reported in San Diego Bay. The estimated cost of cleaning up these spills is 2256,187. Sixty-four percent of these spills and ixty-seven percent of the total costs occurred in the area of the Naval Station. Destroyer-type ships vere responsible for about thirty-two percent of the total spills and twenty-four percent of the costs. Tenders and repair ships incurred the lighest average cost of \$1,381 for each spill, while he fueling pier averaged \$587 per spill. A linear egression between clean-up cost as the dependent variable and the frequency of oil spills as the independent variable generated an average frequency of oil spills of 9.4, an average clean-up cost of 4,066, and a correlation coefficient of 0.73. The lata further indicates that a high monthly clean-up cost tends to be followed by downward sloping costs for the next eleven months after which cost starts to sharply increase again. One possible explanation for this phenomenon is the traditionally high summer personnel turnover rates in the Navy.
Regressions of cost on time and frequency on time produced low correlation coefficients. (See also W73-02901) (Settle-Wisconsin) W73-02906

REDUCTION OF OIL SPILLS DURING SHIP-BOARD FUEL MOVEMENT EVOLUTIONS, Naval Postgraduate School, Monterey, Calif.

In: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate School, p 232-256, March, 1972. 2 fig. 5 tab, 8 ref.

Descriptors: "Oil spills, "Oil pollution, "Fuels, "Evolution, Control, Ships, Indicators, Costs. Identifiers: "Fuel movement evolution, "Fuel oil, Causes, Prevention, Prevention costs.

The causes of Navy oil spills during fuel movement evolutions are categorized into three subgroups: indication, control, and other. The control subgroup contains those causes which could have been eliminated if a positive means of control of the fueling evolution had been employed. The indication subgroup is comprised of causes brought about by an inadequate tank level indicating system. These two subgroups combined account for 77.9 percent of the oil spills for all Navy ships in the sample. The two subgroups account for 91.1 percent of oil spills from destroyers. These spills could be nearly eliminated through the adoption of either one of two solutions. The indirect approach would attempt to eliminate the causes that lead to overfilled tanks by providing instrumentation of all fuel oil tanks which overflow overboard. The direct approach would attempt to minimize the possibility of overfilling tanks. It would reduce the ber of tanks that overflow overboard by internally rerouting overflow lines to designated overflow tanks, which would have external overflow lines, and then instrumenting these tanks. The direct method is recommended for destroyers since its maximum implementation cost is \$5.5 million, while the indirect method would cost about \$6.2 million per destroyer. (See also W73-02901) (Settle-Wisconsin) W73-02907

ANALYSIS OF THE EFFECTS ON OIL SPILLS OF FUEL POLICY CHANGES AND THE ADDI-TION OF ANOTHER FUEL PIER WITH THE AID OF A COMPUTER SIMULATION MODEL, Naval Postgraduate School, Monterey, Calif.

S. K. Laabs, and T. L. Bowman.

In: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate School, p 257-292, March, 1972. 7 fig, 4 tab, 9 ref.

Descriptors: *Oil spills, *Fuels, *Piers, Costs, Renefits

Identifiers: *Refueling policies, *Fuel pier utiliza-tion, *Fuel piers, Cleanup costs, Cost savings,

A limited simulation model is developed for analyzing the effects of changes in refueling poli-cies and in fuel pier utilization on oil spills. Two changes in U.S. Navy refueling policy are examined: (1) lowering the minimum fuel percentage required on board, and (2) establishing a maximu allowable level to which fuel tanks may be filled. Simulations indicated that it would be necessary to reduce the on-board fuel requirements to a drasti-cally low level in order to noticeably affect the oil spill clean-up costs. For instance, if the require-ment was reduced to 50 percent, the clean-up costs would only be reduced by \$6,000 or 11 percent. Simulations also indicated that restricting Navy ships from filling fuel tanks above a maximum level of, say, 90 percent would significantly reduce the number of spills caused by overflows. If such a policy were only 50 percent effective, clean-up costs would be reduced by approximately 45 percent. The study suggests that both refueling p cies should be implemented concurrently. Finally, the study suggested that a policy requiring the exclusive use of fuel piers for fuel exchanges could reduce the number of oil spills by up to 48 percent. (See also W73-02901) (Settle-Wisconsin) W73-02908

THE CONTAINMENT AND RECOVERY OF NAVY OIL SPILLS-A FINANCIAL ANALYSIS, Naval Postgraduate School, Monterey, Calif. R. G. Anderson.

In: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate School, p 293-312, March, 1972. 5 tab, 6 ref.

Descriptors: *Oil spills. *Oil pollution, Costs.

Identifiers: *United States Navy, *Financial analysis, *Cleanup costs, Oil containment, Oil recovery, Alternatives.

The three basic alternatives by which the U.S. Navy can provide for the containment and recovery of its oil spills are (1) a complete Navy inhouse capability, (2) the exclusive use of contract services, and (3) a combination of Navy and contract services. The cost of containing and recovering U.S. Naval oil spills in the San Diego area under these alternative approaches is estimated for the ten-year period beginning in 1971. A present value figure for these cost flows is obtained by applying the standard Department of Defense rate of ten percent. The discounted present cost of a complete Navy in-house capability is estimated to be \$2,470,020, with personnel costs representing more than 75 percent of this total. The present cost of complete contract servicing for the ten-year period is estimated to be \$686,300. The two other options for which discounted present cost estimates are provided are (1) an in-house Navy system capable of handling spills not exceeding 100 gallons, utilizing contract services for larger spills (\$1,221,682); and (2) the development of a Navy oil spill containment capability, utilizing contract services for the recovery of the oil (\$1,237,135). (See also W73-02901) (Settle-Wisconsin) W73-02909

LOCATION AND EQUIPMENT FOR OIL RECOVERY TEAMS IN SAN DIEGO. Naval Postgraduate School, Monterey, Calif.

C. R. Murphy, Jr.

In: Immediate Cost-Effective Abatement of Water Pollution From Navy Ships, Naval Postgraduate School, p 313-337, March, 1972. 5 tab, 15 ref.

Descriptors: *Oil spills, *Oil pollution, *Control,

Time, Distance.
Identifiers: *Oil recovery teams, *Location, *Cost effectiveness. Oil control. Oil control methods.

A mathematical programming technique is applied to data on San Diego oil spills in order to deter-mine the most effective locations at which oil recovery teams should be stationed. Four San Diego Naval facilities were considered as potential sites for recovery teams: Chollas Creek at the Naval Station, the Naval Air Station North Island, the Naval Electronics Laboratory pier at Fleet Training Group, and the Fuel pier. The overall ef-fectiveness of the recovery teams is maximized when teams are stationed at all four locations. Four teams would be about three times as effective as one team located at the best single location. the Naval Station. The overall effectiveness is improved by nearly a third over that of a single team location when a second team is based at North Island. Deployment of a third team to the Fuel pier results in another substantial increase in overall effectiveness. However, placing a fourth team at the Laboratory pier improves system effectiveness by less than 3 percent. Consequently, this fourth deployment is not recommended. Several devices and methods for oil spill control are examined including containment booms, sorbing and gelling agents, physical retrieval devices, chemical dispersion, sinking agents, burning, and biodegradation. (See also W73-02901) (Settle-W73-02910

Group 5G-Water Quality Control

THE RELATIONSHIP BETWEEN LAND USE AND ENVIRONMENTAL PROTECTION, Argonne National Lab., Ill. Center for Environmental Studies.
For primary bibliographic entry see Field 04A.

MATHEMATICAL MODELS FOR REGIONAL ECONOMIC AND WASTE LOAD PROJEC-

Environmental Protection Agency, New York. Data Systems Branch. stems Branch. sary bibliographic entry see Field 05B. For primar W73-02920

AN ECONOMIC INVENTORY OF THE MIAMI RIVER AND ITS ECONOMIC AND ENVIRON-MENTAL ROLE IN BISCAYNE BAY, Miami Univ., Cora Gables, Fla. For primary bibliographic entry see Field 04A. W73-02923

THE GENERAL ECONOMY. Chase Econometric Associates, Inc., Philadelphia,

Available from the National Technical Informa-tion Service as PB-207 204, \$5.45 in paper copy, \$0.95 in microfiche. 1972. 124 p, 1 fig, 23 tab, 1 ap-

Descriptors: *Pollution abatement, *Economic impact, *Investment, *Standards, Prices, Employment, Econometrics, Mathematical models. Identifiers: Output.

The Chase Econometrics Macroeconomic Model and Inter-Industry Forecasting System is used to estimate the effects pollution control standards and concomitant cost increases in certain specified and concommand ross increases in certain spectified industries will have on the overall economy. Key variables examined include the aggregate price in-dices, the unemployment rate, output, and the net foreign balance. Pollution control costs result in foreign balance. Pollution control costs result in higher product prices and new demands for investments in pollution control facilities by industry. The effect of these rising prices, which tends to slow the growth of demand in the economy, outweighs the stimulating impact of investments in pollution control facilities. Consequently, the rate of growth in gross national product in constant dollars is retarded. An increase in unemployment prices from this slowdown in real product courts. arises from this slowdown in real product growth.
The current account balance of international trade
deteriorates primarily as a result of the increase in deteriorates primarily as a result of the increase in domestic prices relative to world prices. Monetary and fiscal policy adjustments can be initiated to completely offset the slowdown in gross national product and employment declines but at the ex-pense of more rapid price rises and further declines in the balance of trade. Data generated by the model are provided. (Settle-Wisconsin) W73.79099

SURVEY OF THE MERCURY REPROCESSING INDUSTRY, 1968-1970, Oak Ridge National Lab., Tenn

Oak Ridge National Lao, 1 tenn.

W. E. Clark, and W. Fulkerson.

Oak Ridge National Laboratory-National Science Foundation Environmental Program, Report ORNL-NSF-EP-22, October, 1972. 13 p, 1 fig, 1 tab, 3 ref, 3 append. W. 7405-eng-26.

Descriptors: *Mercury, Industries, Surveys, Prices, Profit. Identifiers: *Mercury reprocessing, *Reprocessing.

The mercury reprocessing industry is too small and unstable to support an industry association. Consequently, identifying the firms engaged in mercury reprocessing is a difficult task. Sixty-one possible reprocessers were contacted during the

aurvey. Of the 27 firms that completed the questionnaire, 9 reprocessed various amounts of mercury. The survey indicated that the amount of mercury reprocessed in 1968, 1969, and 1970 was 664,152 pounds, 681,962 pounds, and 579,788 pounds, respectively. The decrease in the volume recycled from 1969 to 1970 is probably accounted for by the decrease in the price of mercury which made reprocessing less attractive. In late 1969, the price of mercury was about \$6.50 per pound. By late 1971, its price had fallen to about \$3.39 per pound. By April, 1972, the price had fallen to about \$1.80 per pound. Consequently, much previously recycleable mercury will probably end up in landfills or in even less desirable places. Appendices contain (1) a list of the 61 fims contacted for the survey, (2) a list of the active mercury survey. Of the 27 firms that completed the auces contain (1) a list of the ol fims contacted for the survey, (2) a list of the active mercury reprocessors, including 10 known processors who failed to respond to the questionnaire, and (3) a copy of the questionnaire used in the survey. (Set-tle-Wisconsin) W73-02931

ON THE POSSIBILITY OF A MARKET FOR EXTERNALITIES, Pennsylvania Univ., Philadelphia.

For primary bibliographic entry see Field 06B. W73-02933

LITERATURE REVIEW: ECONOMICS, Rutgers - The State Univ., New Brunswick, N.J. W. Whipple, Jr.
Journal of the Water Pollution Control Federation,
Vol 44, No 6, p 996-1003, June, 1972. 87 ref.

Descriptors: *Publications, *Reviews, *Environ-mental effects, *Water pollution, Pollution abate-ment, Economics, Welfare (Economics). Identifiers: *Literature review, Economic theory, Applied economics.

Seventy-nine recent contributions to the literature on environmental economics in general and water resources economics in particular are briefly reviewed. Many of the publications were theoretireviewed. Many of the publications were theoreti-cal in nature and focused on such topics as the principles of multiple-objective planning, the quantification of benefits including those derived from social welfare functions, interactions between the economy and natural environment, the efficacy of tax-subsidy tools for pollution con-trol, the differential environmental effects of pol-lution-permitting and pollution-prohibiting laws, and common-property resources. Several con-tributions examined various aspects of environ-mental planning. Most found a need for a larger and more efficient allocation of resources to the planning function. Many reports were issued con-cerning the evaluation of pollution control benefits. Contributions focused on such topics as benefits. Contributions focused on such topics as estimation of benefits through the damage-prevention approach, regional development and income distribution aspects of pollution control, and the implications of differing cultural values for evaluating benefits. The possibility of applying taxes or user charges for enforcement purposes attracted a great deal of favorable attention. Contributions also discussed such topics as the cost of waste water treatment, public attitudes toward water quality, and water reuse. (Settle-Wisconsin) W73-02934

TAXATION AND POLLUTION-SOME COM-MENTS, Purdue Univ., Lafavette, Ind.

A. Whinston.

(1970), 10 p, 5 ref. OWRR B-020-IND (18).

Descriptors: *Pollution taxes (Charges), *Cost al-Descriptors: "Pontuon taxes (Charges), "Cost at-location, "Economic efficiency, Equity, Marginal costs, Costs, Prices, Pollution abatement, Waste water treatment, Rivers. Identifiers: "Incremental costs, Total costs.

Several types of effluent charge systems have been proposed in the literature. In general, these various pricing and cost allocation schemes are un-desirable because (1) they fail to collect enough revenue to meet total costs of waste treatment, (2) some of the pricing systems are not based on the most efficient combination of treatment methods, and (3) they fail to satisfy acceptable equity criteria. There is, however, a cost allocation system which adequately deals with these problems. It is a method of allocating the total system costs to polluters based on the idea of each polluter paying the incremental costs he creates. This approach takes as given the present composition of polluters in the river and the given quality goals and attempts to allocate the costs of a basin-wide system. This incremental-cost pricing scheme satisfies the following axioms: (1) charges for the use of the basin treatment system must revenue to meet total costs of waste treatment, (2) scheme satisfies the following axioms: (1) charges for the use of the basin treatment system must cover costs; (2) a user's charges are based only on the incremental cost caused by the user; (3) the charge is independent of the ordering of the users; and (4) a given increase in a user's incremental costs will result in an equal increase in the user's charge. (Settle-Wisconsin)
W73-02935

ECONOMIC EFFICIENCY VS. ENVIRONMENTAL QUALITY IN SMALL WATERSHED DEVELOPMENT, Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 04D. W73-02936

COST ALLOCATION FOR A REGIONAL POL-

LUTION TREATMENT SYSTEM, E. Loehman, D. Pingry, and A. Whinston. (1970), 44 p. 1 fig. 11 tab, 13 ref. OWRR B-020-IND (19) 14-31-0001-3080.

Descriptors: "Waste water treatment, "Cost allocation, "Pollution taxes (Charges), "Marginal costs, Economic efficiency, Equity, Pollution abatement, River basins, Regional analysis, Mathematical models. Identifiers: *Incremental costs, Mathematical pro-

A mathematical programming model of a river basin is developed. The model's objective is to minimize the sum of the construction, operation, and maintenance costs of all treatment structures in a river basin, subject to the constraint that the required level of water quality is maintained plus other institutional and physical constraints. Even after the model has been solved, the problem of how to implement and finance a basin-wide treat-ment system remains. Pricing and cost allocation ment system remains. Pricing and cost allocation schemes generally presented in the literature are found to be undesirable because the fail (1) to cover total treatment costs, (2) to be based on the most efficient combination of treatment methods, most efficient combination of treatment methods, and (3) to satisfy acceptable equity criteria. As an alternative pricing system, an incremental-cost pricing scheme is developed. This system satisfies the following axioms: (1) charges are adequate to cover treatment costs, (2) a user's charges are a function only of the incremental costs caused by the user and (3) arises incremental costs caused by the user, and (3) a given increase in a user's incre-mental costs results in an equal increase in that user's charges. The programming model and incre-mental-cost allocation system are applied to the West Fork White River in Indiana. (Settle-Wisconsin) W73-02937

ECONOMIC IMPACT OF ANTICIPATED PAPER INDUSTRY POLLUTION—ABATEMENT COSTS, PART I: EXECUTIVE SUMMARY. Little (Arthur D.), Inc., Cambridge, Mass.

Available from the National Technical Informa-tion Service as PB-207 144, \$3.00 in paper copy,

\$0.95 in microfiche ironmental Qualit

Descriptors: *Poll *Economic impac Mills, Regulation, (Identifiers: Mill sh

The economic impatandards on the patential 1971-1976 period. costs will result in to 10 percent of newspri board, newspris oard. Price increa board. Price incres in such product s combination pape ing papers, dissolv paper. The anticip dards will signific probabilities in su chemical pulp, tis paper, special ind paperboard. Less pected in other result in about 16 tional 32,000 jobs service and supp pact will be felt in tic and North Ce account for about unemployment. impact upon mar for paper produ (Settle-Wisconsin W73-02941

SYSTEMS ANAI MANAGEMENT Manhattan Coll... gineering. R. V. Thomann. Environmental vironmental Rese York, N.Y., 1972 170 ref.

Descriptors: *S models, *Water *Cost-benefit an put analysis, Di Basin Commissi Linear programs Identifiers: *So environment, *! charges, Econon

A plea is prese water quality ma cannot be solve tion of wastes removal of was political situation control. Cause/e not be ignored needed to provi sions on alterna contains three Setting,' provid water uses that quality. In part the principles of well as the cons river and estu described. Part aspects of wate cost/benefit and water quality m
The final chapt
prehensive pla
ment, using the
setting. (Bell-Co
W73-02943

WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

Water Quality Control—Group 5G

50.95 in microfiche. Report to the Council on Environmental Quality, November, 1971. 15 p, 7 tab.

Descriptors: *Pollution abatement, *Standards, *Economic impact, *Pulp and paper industry, Mills, Regulation, Costs, Prices, Employment. Identifiers: Mill shutdowns.

The economic impact of air and water pollution The economic impact of air and water poliution istandards on the paper industry is analyzed for the 1971-1976 period. Increased pollution abatement costs will result in price increases ranging from 6.5 to 10 percent of current product value in hard-board, newsprint, uncoated groundwood, bleached kraft pulp, and unbleached kraft lineroleached Kratt pulp, and unbreached Kratt inter-board. Price increases of 3.5 to 6 percent will occur in such product sectors as bleached paperboard, combination paperboard, insulation board, print-ing papers, dissolving pulp, and bag and wrapping paper. The anticipated pollution abatement stan-dards will significantly increase mill shutdown hards will significantly increase mill shutdown probabilities in such sectors as sulfite and semichemical pulp, tissue paper, printing and writing
paper, special industrial paper, and combination
apperboard. Less extensive dislocations are expected in other sectors. These shutdowns will
result in about 16,000 lost jobs by 1976. An addicional 32,000 jobs will be lost in associated local
service and supplier industries. The greatest impact will be felt in the New England, Middle Atlantic, and North Central regions, which together will
account for about 85 percent of the paper industry
unemployment. There should be no measurable unemployment. There should be no measurable impact upon market demand trends since demand for paper products is generally price inelastic.
(Settle-Wisconsin)
W73-02941

SYSTEMS ANALYSIS AND WATER QUALITY

MANAGEMENT, Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering. R. V. Thomann.

Review of the American Review of the Review

Descriptors: *Systems analysis, *Mathematical models, *Water quality control, *Management, *Cost-benefit analysis, *Optimization, *Input-out-put analysis, Dissolved oxygen, Delaware River Basin Commission, Estuaries, Streams, Rivers, Linear programming, Simulation analysis, Water utilization.

Identifiers: *Socio-economic aspects, *Physical environment, *Deterministic models, *Effluent charges, Economic analysis.

A plea is presented for a systems approach to water quality management. The pollution problem cannot be solved by calling for complete elimina-tion of wastes or even maximum technological removal of wastes. Economics and the prevailing political situation must be recognized as facts of life when dealing with the problems of pollution control. Cause/effect and economic realities must control. Cause/effect and economic readless must not be ignored. Therefore, systems analysis is needed to provide rational bases for making deci-sions on alternative courses of action. The book contains three sections. Part I, 'The Problem Setting,' provides a brief overview of the major setting, provides a one: overview of the major water uses that affect or are affected by water quality. In part II, 'The Physical Environment,' the principles of water quality systems analysis, as well as the construction and application of stream, river and estuarine water quality models are described. Part III presents the socio-economic described. Part III presents the socio-economic aspects of water quality management. Discussed is cost/benefit analysis in water quality control, and water quality management models are formulated. The final chapter reviews basic concepts of comprehensive planning for water quality management, using the Delaware Estuary as the problem setting. (Bell-Cornell) W73-02943

CULTURE OF THE VELLOW PERCH IN THE

CULTURE OF THE TELLOW FEACH IN THE LABORATORY, National Water Quality Lab., Duluth, Minn. J. G. Hale, and A. R. Carlson. Progressive Fish Culturist, Vol 34, No 4, p 195-198, October 1972. 1 fig, 1 tab, 6 ref.

Descriptors: Fish, *Perches, Fish food organisms, *Yellow perch, Eggs, *Larvae, Laboratory animals. Identifiers: *Toxicity tests.

Yellow Perch, Perca flavesceus, (Mitchill) were cultured and reared successfully under laboratory conditions. Larvae were reared under static conditions and at 4 and 6 water turnovers per 24 hours. Survival decreased as the flow increased. (EPA abstract) W73-02952

SUCCESSFUL SPAWNING OF LARGEMOUTH BASS, MICORPTERUS SALMOIDES (LACEPEDE) UNDER LABORATORY CONDI-TIONS,
National Water Quality Lab., Duluth, Minn.

Transactions of the American Fisheries Society, Vol 101, No 3, p 539-542, July 1972. 1 fig, 1 tab, 9

Descriptors: *Bass, *Fish reproduction, *Spawning, Laboratory Animals, *Largemouth bass, Gravel.

Largemouth bass spawned successfully in the laboratory. Viable embryos were spawned on three substrates: gravel, nylon mat, and Spanish moss. (EPA abstract) W73-02953

TOWARDS A PHILOSOPHY OF PLANNING: AN INVESTIGATION INTO ATTITUDES HELD BY FEDERAL WATER RESOURCE PLAN-

Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 06E. W73-02955

AN APPROACH FOR INVOLVING LOCAL OF-FICIALS AND CITIZENS IN REGIONAL WATER QUALITY STUDIES, Stanford Univ., Calif. Dept. of Civil Engineering.

J. M. Califf, Jr.

Engineering-Economic Planning Program Publica-tion No EEP-44, 1971, 197 p. FWQA Program

Descriptors: *Planning, *Decision-making, *Public participation, Attitudes, *San Francisco Bay, Water quality, *California, *Regional analy-sis, Water pollution control.

case study is made of the 'Bay-Delta Program', a three-year water quality study of the San Francisco Bay-Delta area completed in 1969. Methods for local involvement used in that study are described, along with results of a detailed mail sur-vey distributed to local officials. The survey focuses on local opinions concerning the value of the public involvement procedures used and on local attitudes toward alternative methods. Based on the above findings and a literature survey, guidelines for developing local liaison procedures are formulated. (See also W73-02955) (EPA ab-W73-02956

POLLUTION POLICY. Engineering News Record, Vol 185, p 11, May, 1970.

Descriptors: *Effluents, *Standards, *Regulation, *Thermal pollution, Cooling water, Lake Michigan, Illinois, Michigan, Indiana, Wisconsin, Utilities, Nuclear power plants, Industries. The Interior Department unveiled a new thermal pollution policy for Lake Michigan when the Federal Water Quality Administration (FWQA) told representatives from Illinois, Michigan, Indiana, and Wisconsin that all waste discharges into the lake could be no greater than I degree F above ambient lake temperatures. Michigan and Indiana representatives said that the Federal Water Quality Act requires that any standard must be physi-cally and economically feasible and the new policy was neither. Utilities in the four states plan 10 nuclear plants around the lake and all say they could not meet the new standard if it is adopted. Industries also claimed they could not possibly comply with the new policy. (Galwardi-Texas) W73-02999

POLLUTION HEARING SETS A SOUTHERN

Engineering News Record, Vol 185, p 13, January

Descriptors: *Federal project policy, *Waste water treatment, *Regulations, Nutrients, Thermal pollution, *Pollution abatement, Bays, Treatment facilities, Flow around objects, *Florida, Efficiencies, Phosphorus, *Industrial

Identifiers: *Escambia Bay (Fla), Settleable solids, Carbonaceous material, Nitrogenous material.

During a water pollution enforcement hearing the Federal Water Pollution Control Administration directed, for the first time, several companies to remove the nutrients from their waste waters. American Cyanamid, Escambia Chemical, Monsanto, and the City of Pensacola's northeast sewage treatment plant were directed to achieve reductions of 94% carbonaceous material, 94% nitrogenous, 90% phosphorus and all settleable solids in their effluents. Container Corporation was permitted a reduction of only 90% carbonaceous material because of its distance from Escambia Bay. In addition, Century, Florida, and East Brewton, Alabama were directed to have secondary treatment plants in operation no later than December 31, 1972. The Louisville and Nashville Railroad was instructed to either replace or modify an 11,000 foot long tinker trestle so that its piers do not obstruct the circulation and exchange of water in Escambia Bay. Also, Monsanto and Gulf Power Co. were instructed to abate their thermal pollution of the bay by January 1, 1975. Mon-santo and Gulf Power have discharged an esti-mated 50 MGD and 150 MGD respectively, and in Monsanto's case this has raised water tempera-tures a reported 19.5 degrees above background temperatures. (Galwardi-Texas) W73-02960

ENGINEERS SCORE FEDERAL POLLUTION

Engineering News Record, Vol 185, p 23, Februa-

Descriptors: *Federal project policy, *Pollution abatement, Education, *Water pollution control,

At the American Society of Civil Engineers (ASCE) meeting in Memphis, Tennessee, Thomas M. Niles, ASCE President and Samuel S. Baxter, ASCE President-elect criticized Carl L. Klein, Assistant Secretary of the Interior for water quality and research for remarks which they deemed as scare tactics. Klein was reported as saying we may well end up burying ourselves in our own wastes. Both suggested that such statements were adding to public hysteria over pollution of the environ-ment. However, both men emphasize that they were in no way downgrading the nation's water pollution problems. Niles reported that over emphasis on pollution could result in massive outlays of federal monies, brought on by public

Group 5G-Water Quality Control

hysteria and cause the waste of vast sums of money that could be better used for education and housing. (Galwardi-Texas) W73-02961

OXYGEN TRANSFER TO WATER AND TO SODIUM SULFITE SOLUTIONS, British Columbia Univ., Vancouver.
M. S. Liu, R. M. R. Branion, and D. W. Duncan.
Journal Water Pollution Control Federation, Vol 44, No 1, January 1972, p 34-40, 1 tab, 32 ref.

Descriptors: "Oxygenation, "Reaeration, "Mathematical models, Laboratory tests, Analytical techniques, Sodium compounds, Mixing, Oxidation, Hydrogen ion concentration, Fermentation, Aeration, Mass-transfer, Correlation analysis, Regression analysis, Waste water treatment. Identifiers: "Sodium sulfite.

Laboratory tests with artificial aeration were conducted in order to provide data for the formulation of a mathematical model for reaeration both of water and of sulfite solutions. A multiplicative model was assumed and logarithms were used to linearize it. The best fit was obtained by multiple regression analysis. It was also demonstrated that regression analysis. It was also demonstrated that pH does not have a significant effect on mass-transfer capacity coefficients for oxygen transfer from air to water. System power requirements were represented. Because the absorption mechanisms of the sulfite oxidation and unsteady gassing-in techniques are different, care must be taken in :valuating the performance of fermenta-tion equipment. (Lowry-Texas) W73-02962

SALT CREEK TWO STAGE NITRIFICATION

PLANT,
Federal Water Quality Administration, Cincinnati,
Ohio. Advanced Waste Treatment Research Lab.
For primary bibliographic entry see Field 05D.
W73-02963

PROCESS OF PURIFYING WATER BY IR-RADIATING IT, Osaka Prefecture (Japan). (assignee)
For primary bibliographic entry see Field 05D.

REMOVING OIL OR OIL SUBSTANCE FROM WATER AND LAND AREAS USING CORNCOB COMPONENTS, Anderson Cob Mills, Inc., Maumee, Ohio. (as-

W73-02982

augnee)
J. Vander Hooven, and D. I. B. Vander Hooven.
U. S. Patent No. 3,617,564, 3 p, 1 tab, 3 ref; Official Gazette of the United States Patent Office,
Vol 892, No 1, p 255, November 2, 1971.

Descriptors: *Patents, *Oil spills, *Air pollution, Pollution abatement, Treatment, Water pollution control, Water pollution treatment, Water pollution, Water quality control. Identifiers: Corncob meal.

Corncob meal, having a density of between 5 pounds and 20 pounds per cubic foot, is placed upon the oil on a water or beach surface. After it absorbs the oil, the contaminated corncob meal is removed by skimming. (Sinha-OEIS)

ERADICATING OIL SLICKS. Texaco Inc., New York. (assignee) E. L. Cole, and H. V. Hess. U. S. Patent No. 3,617,556, 3 p. 3 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 254, November 2, 1971.

Descriptors: *Patents, *Oil spills, *Oil pollution, Pollution abatement, Equipment, Water pollution control, Water pollution treatment, Water quality control, Water pollution.

A blanket of bulk fabric composed of a solid synthetic polymeric plastic material having a critical surface tension is immersed in the spill area then withdrawn. The oil is removed and the material again immersed in the spill area. The fabric is best used arranged on a drum or endless belt which may be carried by a moving vessel. If the belt moves in the direction of the motion of the vessel the oil piles up and the adsorption of oil is further promoted. (Sinha-OEIS)

METHOD AND APPARATUS FOR REMOVING OIL AND DEBRIS FROM WATER, Standard Oil Co. of Indiana, Chicago, Ill. (as-

Standard Off. Signey
I. Ginsburgh, and R. G. Will.
U. S. Patent No. 3,617,555, 4 p, 5 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 254, November 2, 1971.

Descriptors: *Patents, *Oil spills, *Oil pollution, Equipment, Pollution abatement, *Water pollution treatment, Water pollution control, Water quality control, Water treatment.

A revolving, partly submerged unit projects plastic bristles. The bristles are durable, oil-wettable, and have a high fatigue strength. The bristles provide a massive surface area to which oily material can adhere as the unit revolves in and out of the water. The oily material is removed before the section is again immersed in the water. Polypropylene bris-tles are preferred. (Sinha-OEIS) W73-02997

OIL-WATER SEPARATING PROCESS,

Standard Oil Co. of Indiana, Chicago, Ill. R. G. Will, and J. F. Grutsch. U. S. Patent No. 3,617,552, 3 p, 2 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 892, No 1, p 253, November 2, 1971.

Descriptors: *Patents, *Oil spills, *Oil pollution, Pollution abatement, Equipment, Water pollution control, Water pollution, Water pollution treatment, Water quality control, Separation

A revolving polyurethane foam belt is mounted on an incline. Oil contaminated water filters through the belt. The filter contains two sizes of pores, the one Delt. The filter contains two sizes of pores, the outlayer has larger pores and the inner has smaller pores. As the wetted section is moved out of the water it is squeezed twice to remove the oil. The belt is adapted to filter oils having a wide range of viscosities. (Sinha-OEIS)

METHOD OF RECOVERING OIL FORM AN

OIL SLICK, Texaco, Inc., New York. (assignee). M. H. Van Stavern, W. T. Jones, H. F. Cossey, and W. J. Clark.

U.S. Patent No 3,612,277, 3 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 891, No 2, p 661, October 12, 1971.

Descriptors: *Patents, *Oil spills, *Oil pollution, Pollution abatement, Equipment, Water pollution, Water pollution control, Water quality control.

A roller skimmer is adapted for improved oil recovery and water separation. The oil layer is recovery and water separation. The oil layer is picked up on the main or pickup roll which contacts the slick and coacts with a supplemental or transfer roll arranged parallel to the main or pickup roll and in juxtaposition to it. The transfer roll receives a layer of oil and is coated with it. Scrapers, doctor blades or squeegees on the respective rolls help in recovery of oil from both rolls. (Sinha-OEIS) W73-03007

OIL ENTRAPMENT AND CONTAINMENT

WATERCRAFT,
J. M. Valdespino.
U.S. Patent No 3,615,017, 3 p, 2 fig, 3 ref; Official
Gazette of the United States Patent Office, Vol
891, No 4, p 1396, October 26, 1971.

Descriptors: *Patents, *Oil spills, *Oil pollution, Equipment, Pollution abatement, Water pollution control, Water pollution treatment, Water pollu-tion, Water quality control.

The watercraft has a pair of pontoons buoyantly supporting an open-bottomed entrapment tower and a funnel-shaped surface skimming shroud. As the craft moves along, the oil passes into the skimmer and into the entrapment tower where the column of liquid is raised by vacuum applied to the top of the tower. Oil rises above the water and is pumped off. The buoyancy of the pontoons is controlled by supplying air and water to the top of the pontoon, allowing the water to escape through a slot at its bottom and by providing air purge lines in the pontoons. (Sinha-OELS)

FREEZING OIL SPILLS, Texaco, Inc., New York. (assignee). E. L. Cole, and H. V. Hess. U.S. Patent No 3,614,873, 4 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 891, No 4, p 1359, October 26, 1971.

Descriptors: *Patents, *Oil spills, *Oil pollution, Equipment, Separation techniques, Oceans, Pollu-tion abatement, Water pollution, Water pollution control, Water pollution treatment, Water quality, Freezing, *Carbon dioxide.
Identifiers: *Dry ice.

This method of cleaning up marine oil spills involves the use of dry ice (solid carbon dioxide). Particles of the dry ice are spread over the surface of the oil spill. The oil forms a rigid mass or cakelike layer which is easily removed by screens. The dry ice particles range in size from 1/32 inch to 1/8 inch. (Sinha-OEIS)

MULTICHAMBER FLOATING BARRIER,

R. E. Zaugg. U.S. Patent No 3,613,377, 5 p, 19 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 891, No 3, p 958, October 19, 1971.

Descriptors: "Patents, "Oil spills, "Oil pollution, "Flotsam, Equipment, Barriers, Pollution abate-ment, Water pollution control, Water pollution treatment, Water pollution, Water quality control, Water quality.

The barrier consists of at least three chambers joined to form a triangular cluster of flexible bag-like tubes. It has a ballast chamber partly filled with water and is immersed beneath the other chambers. The main chamber is partially inflated with air and rises shows the water surface liked. chambers. I ne main chamber is partially intinsed with air and rises above the water surface like a large continuous pillow. The supporting chamber is inflated with air and lies above the ballast chamber and behind the main air chamber to help chamber and belief the man air chamber to be support the latter when the wind is strong. The barrier may be used to confine oil floating on the surface of water, or other floating substances. (Sinha-OEIS)

SALT INJURY TO PLANTS WITH SPECIAL REFERENCE TO CATIONS VERSUS ANIONS AND ION ACTIVITIES,
California Univ., Riverside. Dept. of Soil Science. For primary bibliographic entry see Field 03C. W73-03077

MORPHOLOGIC MESQUITE VA PICLORAM, Agricultural Res Research Div. For primary biblio W73-03080

NUTRIENT ST. ENHANCEMENT SOYBEAN, Illinois Univ., Ur For primary biblio W73-03087

MAN AND WAT Geological Surve For primary bibli W73-03090

ECOLOGICAL I National Parks Washington, D.C For primary bibli W73-03092

THE WARWICH OF WATER DE BILITY IN AN SYSTEM, Edinburgh Univ. Natural Resourc For primary bibli W73-03103

FALL RIVER AND RHODE IS Corps of Engin For primary bibl W73-03144

MILWAUKEE WISCONSIN, ()
PACT STATEM Army Engineer

Available from PB-208 655-D, 1972. 23 p.

Descriptors: *D *Water pollution lution sources, Wisconsin, E Seepage contro effects, Data co Identifiers: *Dr bor (Wisc.), *I

The Corps of E

channel project kee County, Wi bor, Ozaukee disposed of the waters of Lake prevent pollute tained area, th environmental i In accordance Federal Water (now EPA) and Engineers to de bottom sedime FWPCA samp April 1968. The ments in Port severely pollut Michigan harb

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

MORPHOLOGICAL RESPONSE OF TWO MESQUITE VARIETIES TO 2,4,5-T AND PICLORAM,

Agricultural Research Service, Tucson. Plant Research Div.

For primary bibliographic entry see Field 04A. W73-03080

NUTRIENT STATUS AND MYCORRHIZAL ENHANCEMENT OF WATER TRANSPORT IN

Illinois Univ., Urbana. Dept. of Plant Pathology. For primary bibliographic entry see Field 03F.

MAN AND WATER: A LESSON IN HISTORY,

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 03F. W73-03090

ECOLOGICAL RIVER BASIN MANAGEMENT. National Parks and Conservation Association, Washington, D.C.

For primary bibliographic entry see Field 06E. W73-03092

THE WARWICKSHIRE AVON: A CASE STUDY OF WATER DEMANDS AND WATER AVAILA-BILITY IN AN INTENSIVELY USED RIVER SYSTEM, Edinburgh Univ. (Scotland). Dept. of Forestry and

Natural Resources. For primary bibliographic entry see Field 06D. W73-03103

FALL RIVER HARBOR, MASSACHUSETTS AND RHODE ISLAND (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT).

Corps of Engineers, Waltham, Mass. New England Div.
For primary bibliographic entry see Field 08A.
W73-03144

MILWAUKEE DIKED DISPOSAL AREA, WISCONSIN, (DRAFT ENVIRONMENTAL IMPACT STATEMENT). Army Engineer District, Chicago, Ill.

Available from NTIS, Springfield, Va 22151 as PB-208 655-D, Price \$3.00 paper copy. February 1972. 23 p.

Descriptors: *Dredging, *Harbors, *Great Lakes, *Water pollution control, *Spoil banks, Water pollution sources, Sediments, Industrial wastes, Wisconsin, Engineering structures, Runoff, Seepage control, Retaining walls, Environmental effects, Data collections.

identifiers: *Dredging disposal, *Milwaukee Har-bor (Wisc.), *Port Washington Harbor (Wisc.), *Environmental Impact Statements.

The Corps of Engineers in dredging the harbor and channel projects at Milwaukee Harbor, Milwaukee County, Wisconsin, and Port Washington Harbor, Ozaukee County, Wisconsin previously disposed of the dredged material in the open waters of Lake Michigan. Proposed action would prevent polluted dredging material from reaching the lake waters by placing this material in a con-tained area, thereby eliminating the undesirable environmental impact of past disposal procedures. In accordance with an agreement between the Federal Water Pollution Control Administration (now EPA) and the United States Army Corps of Engineers to determine the degree of pollution of bottom sediments in harbors to be dredged, FWPCA sampled representative harbor areas in April 1968. They conclude that (1) the bottom sediments in Port Washington Harbor are not as severely polluted as those found in other Lake Michigan harbors, (2) the disposal of these sediments in Lake Michigan would not add substantial amounts of nutrients to the Lake, and (3) the water quality at Port Washington meets reasonable criteria and does not constitute a serious source of pollution except that the amount of phosphorous should be reduced. (Woodard-USGS) W73-03151

EXPERIMENTAL SUBSTANTIATION OF THE MAXIMAL PERMISSIBLE CONTENT OF PEN-TAERYTHRITOL AND XYLITOL IN WATER BODIES, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Gigieny,

Moscow (USSR).

S. I. Plitman

Gig Sanit. Vol 36, No 2. p 25-29. 1971. Illus. English summary. Identifiers: *Pentaerythritol, *Xylitol, USSR.

The following maximal permissible concentrations

were recommended: pentaerythritol-0.1 mg/1, xylitol-1.0 mg/1.--Copyright 1972, Biological Abstracts, Inc. W73-03159

METHYL MERCURY ACETATE FROM WATERS BY CHROMATOGRAPHY ON CHELATING POLYMERS, Bologna Univ. (Italy). Ciamician Chemical Inst.

For primary bibliographic entry see Field 05A. W73-03179

PERSPECTIVES AND GOALS FOR WATER RESOURCE PLANNING, North Carolina Univ., Chapel Hill.

For primary bibliographic entry see Field 06B. W73-03182

ENVIRONMENTAL PLANNING AND ECOLOG-ICAL POSSIBILITIES,
Oregon State Univ., Corvallis. Dept. of Civil En-

gineering. For primary bibliographic entry see Field 06G. W73-03184

EFFECT OF DISSOLVED SALTS ON WATER

SOLUBILITY OF LINDANE, Connecticut Univ., Storrs. Dept. of Chemistry. W. L. Masterton, and T. P. Lee. Environmental Science and Technology, Vol 6,

No 10, p 919-921. October 1972. OWRR A-013-CONN (8). 14-01-0001-3007.

Descriptors: *Pesticides, *Halides, Solubility, Chromatography, Halogenated pesticides.
Identifiers: *Aqueous salt solutions, Dissolved salts *I indane

The effect of 14 different 1:1 salts on the water solubility of lindane (gamma-hexachlorocyclohexane) has been measured. In 10 cases, salting out is observed; the greatest decrease in solubility is found with the alkali fluorides, KF and NaF. The four electrolytes that salt in lindane (Nal. KI. (CH3)4NCl, (C3H5)4NCl) contain large ions. The order of the Setschenow parameters calculated from solubility data for lindane parallels that for benzene. Except for the fluorides, the extent of salting out is less for lindane than for benzene.

W73-03185

SURCHARGES AND STREAM CHARGES AS ECONOMIC INCENTIVES.

North Carolina State Univ., Raleigh. Dept. of Economics.

J. A. Seagraves. Paper Presented at A National Symposium on Costs of Water Pollution Control, Raleigh, North Carolina, Apr 6-7, 1972, 17 p, 2 fig, 3 tab. OWRR B-032-NC (3). Descriptors: "Municipal wastes, "Industrial wastes, "Sewerage, Water rates, "Legislation, North Carolina, "Pollution taxes (Charges). Identifiers: "Surcharges, "Sewer rates.

A 2-year study of effect of surcharges on industrial wastes is summarized. Data obtained from 24 U.S. cities water and sewer rate schedules together with water use and waste discharges and time series for value added by manufacturing in each city, local wage rates, and consumer price index are presented. Regression equations are given along with demand curves for waste treatment and water. Surcharges were found to bring ment and water. Surcharges were found to bring substantial reductions in industrial wastes. If industries were charged 4 cents per pound of BOD, they would find ways to reduce wastes by one billion pounds per year at a cost of only 2 cents per pound. (Howells-North Carolina)

ROUND TABLE MEETINGS ON THE DETERI-ORATION OF THE ENVIRONMENT; CON-FERENCE (IN SPANISH). Instituto Mexicano de Recursos Naturales

Renovables, A.C., Mexico City.
For primary bibliographic entry see Field 06G.
W73-03195

RESIDUE REVIEWS, VOL. 33.

Springer-Verlag: New York, N. Y.; Heidelberg, West Germany. 1970. 144 p. Pr. \$14.80. Identifiers: Books, Citrus-D, Feeds, Food, *Insec-ticides, Microorganisms, *Pesticide residues, Plankton, *Reviews.

This volume contains 6 contributions concerning the residues of pesticides and other foreign chemicals in foods and feeds. The first paper discusses pesticide regulations and residue problems in Poland, followed by a contribution concerning the interaction of pesticides with aquatic microorganisms and plankton. The next paper discusses the photochemistry of halogenated herbicides. A discussion on the tolerances of pesticide residue in Czechoslovakia precedes a paper on terminal residues of insecticides and their synergists in foodstuffs. The final contribution describes acaricide residues on citrus foliage and fruits and their biological significance.—Copyright 1972, Biologi-cal Abstracts, Inc. W73-03197

QUALITY OF THE WATER USED FOR HUMAN CONSUMPTION (IN FRENCH),

O. Lacambre.
Rev Epidemiol Med Soc Sante Publique, Vol 19, No 7, p 627-640, 1971, Illus, English summary. Identifiers: Water quality control, *Potable water, *Water quality standards.

In view of the increasing needs and of the decrease in underground water resources, the large cities will, at some future date, have to draw their drinkwill, at some future date, have to draw their driking H2O from generally polluted rivers. The criteria for the quality of drinking H2O are indicated according to the Furopean standards proposed by the WHO Regional Office in 1970. To reach these standards, it is necessary to improve the quality of natural H2O and to improve the treatment processes. Some harmful elements can be eliminated without much expense, whereas others necessitate specific processes or elaborate techniques.—Copyright 1972, Biological Abstracts, W73-03204

AN ECOLOGICAL STUDY OF THE SOIL MICROFUNGI IN A HAWAIIAN MANGROVE

Hawaii Univ., Honolulu. Dept. of Botany. For primary bibliographic entry see Field 021. W73-03205

Group 5G-Water Quality Control

NEW ATTITUDES ABOUT LEGAL PROTEC-TION FOR REMAINS OF FLORIDA'S NATU-

TION FOR REMAINS OF FLORIDA S. A.R. RAL ENVIRONMENT, Florida Univ., Gainesville. Coll. of Law. For primary bibliographic entry see Field 06E. W73-03216

MISSOURI (ANALYSIS OF STATE WATER POLLUTION LAW AND COMPARISON WITH PRESENT AND PROPOSED TENNESSEE LAW), For primary bibliographic entry see Field 06E. W73-03217

NORTH CAROLINA (ANALYSIS OF STATE'S WATER POLLUTION LAW AND COM-PARISON WITH PRESENT AND PROPOSED TENNESSEE LAW),
For primary bibliographic entry see Field 06E.

W73-03218

TEXAS (ANALYSIS OF STATE WATER POL-LUTION LAW AND COMPARISON WITH PRESENT AND PROPOSED TENNESSEE LAW), For primary bibliographic entry see Field 06E.

SYSTEMS APPROACH TO PROBLEMS OF WATER POLLUTION CONTROL, Michigan Univ., Ann Arbor. School of Public

R. A. Deininger, and D. P. Loucks.

In: Systems Approach to Environmental Polluin: Systems Approach to Environmental Foliu-tion, Part II (Systems Approach to Water Pollu-tion), Operations Research Society of America, Arlington, Virginia, 1972, editor G. K. Chacko, p 139-221, 95 ref.

*Systems analysis. *Analytical Descriptors: Descriptors: "Systems analysis, "Analytical techniques, "Computers, "Water quality control, "Waste water treatment, "Waste water disposal, "Decision making, Planning, Mathematical models, Management, Economic impact, Economic efficiency, Hydrologic aspects, Political and Part of the Property of the Pr

A systems approach is one where problem solving focuses primarily on the entire system, rather than its separate components. Some analytical and computational methods of analyzing water quality management systems, from wastewater collection, treatment and disposal to its subsequent effect on the receiving bodies of water are reviewed. These techniques are not substitutes for judgment, but only a means of enhancing judgment by providing only a means of ennancing judgment by providing information. Some of the more obvious types of information and opportunities provided by systems approaches to water quality problems are:

(1) increased capability for evaluating alternatives and keeping more options available for analyses at each level of decision making; (2) improved capacity for testing assumptions and data to estimate the effects of economic, hydrologic, political and technological uncertainties; (3) making all assumptions and their consequences explicit and available for criticism; and (4) a common language for planners from many different disciplines. Even without precise objectives, systems techniques can be used to define sets of politically as economically effective alternatives. (Campbell-Cornell) W73-03222

SYSTEMS APPROACHES TO MICROSCALE PROBLEMS OF WATER POLLUTION CON-TROL, Texas A and M Univ., College Station. Dept. of In-

dustrial Engineering.
C. S. Shih, J. A. DeFilippi, and P. Krishnan.
In: Systems Approach to Environmental Pollution, Part II ('Systems Approach to Water Pollution, Part III ('Systems Approach to Water Pollution, Part III (tion'), Arlington, Virginia, 1972, editor G. K. Chacko, p 225-263. 9 fig, 6 tab, 23 ref.

Descriptors: "Systems analysis, "Water quality control, "Mathematical models, "Optimization, "Planning, "Waste water treatment, "Costs, "Design, "Dynamic programming, "Methodology, Data processing, Computers, Management, Treatment facilities.

Most applications of the systems approach have Most applications of the systems approach have emphasized overall water quality management and control (macro-scale concerns). In view of the so-phisticated planning of today, the systems ap-proach should now be applied more often to micro-scale problems like analysis, selection and design of wastewater treatment facilities. Six areas of micro-scale problems appear to be amenable to solution by the systems (modelling) approach: solution by the systems (modelling) approach:
plant design, unit process optimization, optimal
system design, cost, reliability of operations, and
plant operation. An application of dynamic programming to a treatment plant process design is
presented. The optimization procedure integrates
dynamic programming techniques into existing
process design principles. The purpose is to
develop a methodology of analysis which identifies the ontimum combinations and efficiencies of fies the optimum combinations and efficiencies of ness the optimum combinations and efficiencies of various unit processes from a range of available al-ternatives for a multi-stage plant. This optimiza-tion methodology is called the 'two-point bounda-ry value problem.' (Campbell-Cornell) W73-03223

SYSTEMS APPROACH TO WATER POLLU-

TION CONTROL - A DISCUSSION,
Pennsylvania Dept. of Environmental Resources,
Harrisburg. Bureau of Sanitary Engineering.

In: Systems Approach to Environmental Pollution, Part II ('Systems Approach to Water Poliution'), Operations Research Society of America, Arlington, Virginia, 1972, editor G. K. Chacko, p

Descriptors: *Systems analysis, *Water quality control, *Management, *Planning, Pennsylvania, Land use. Economics.

Some aspects of the papers by Shih and Deininger are discussed. Pennsylvania's systems ex-periences and needs, and the broader meaning of systems applications to water pollution control are reviewed. Pennsylvania has been developing a Water Quality Management Information System consisting of six subsystems for facilities, project status, monitoring, public relations, and evaluating priorities, as well as the conventional water quality data. Systems application must be expanded to cover forecasting, land use planning, and emergency solutions. Learning to forecast and control the consequences of economic and technologic growth is essential. (Campbell-Cornell) W73-03224

THE MIAMI CONSERVANCY DISTRICT EX-PERIENCE IN THE SYSTEMS APPROACH TO WATER QUALITY IMPROVEMENT,

Miami Conservancy District, Dayton, Ohio. R. F. Thomas.

In: Systems Approach to Environmental Pollu-tion, Part II ('Systems Approach to Water Pollu-tion'), Operations Research Society of America, Arlington, Virginia, 1972, editor G. K. Chacko, p 279-285.

Descriptors: *Systems analysis, *Water quality control, *Water resources, *Simulation analysis, *Costs, *Model studies, *Decision making, Data collections, Flood control, Management, Land

management, *Ohio.
Identifiers: Ohio River, Great Miami River (Ohio), Ohio Conservancy Act, The Miami Valley Water Quality Committee, Ohio Water Pollution Control Board, Franklin (Ohio).

The Miami District conservancy mechanism (originally developed for flood control) is now

being used to manage water quality in the Great Miami River. It has utilized quantitative analysis, principally through simulation of stream dissolved oxygen and temperature profiles resulting from various combinations of individual and regional various combinations of individual and regional facilities. Capital, operation costs and present worths of these alternatives have been developed. The recent district program through staffing, data collection, model verification and examination of facilities has provided for initial short-term decisions. At the same time this work is developing a constant of the program than (5.1) years) more sions. At the same time this work is developing a framework for a longer term (5-10 years) more elaborate systems technique. The District program is based on participation by industries and towns, fees charged to holders of control board permits, analysis of data and of effectiveness of alternative systems, individual and regional facilities, and recognition of the importance of aesthetics and re-lated land resources. (Campbell-Cornell)

PROGRAMMING MODEL OF REGIONAL WATER QUALITY MANAGEMENT, California Univ., Berkeley. Dept. of Industrial Engineering and Operations Research. S. K. Mukherjee.

S. K. Muknetjee.
In: Proceedings of 14th Congress of International
Association for Hydraulic Research, Hydraulic
Research and its Impact on the Environment, Vol
5, p 277-292, 29 August-3 September 1970. 6 p, 5
fig, 2 ref.

Descriptors: "Water quality control, "Estuaries, "Waste water treatment, "Linear programming, Effluents, Pollution abatement, Dispersion, Advection, Costs, Optimization, "California. Identifiers: "San Francisco Bay system.

A multi-component linear programming model of water quality control in an estuary was presented. water quality control in an estuary was presented. Given a prescribed estuarine water quality standard, expressed as maximum allowable concentrations of multiple water qualaity constituents, this model obtained an optimal plan of effluent treatment for the waste-producing agencies along with an optimal plan of effluent discharge in the estuary by minimizing the total cost of pollution abatement for the estuarine region. The linear programming model was based on a one-dimensional description of longitudinal dispersion and advection of polluof longitudinal dispersion and advection of pollu-tants discharged in an estuarine basin. Several water quality constituents, both conservative ar degradable, were considered by the model. An application of the model in the San Francisco Bay system was described. It was shown that the total treatment costs over the entire basin using the op-timal solutions was much lower than the costs when uniform treatment policy was used. One of the ways to effect the allocation of costs and to motivate the individual waste dischargers to use the optimal solution was through a system of charges on effluents based on their quantity and sition. (Veverka-Cornell) W73-03240

BENEFITS OF FLOW AUGMENTATION FOR WATER QUALITY CONTROL, Florida Univ., Gainesville. Dept. of Environmental Engineers.

tal Engineering. J. E. Heaney, and E. E. Pyatt.

In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 345-349, 29 August-3 September 1970. 5 p, 1

Descriptors: *Flow augmentation, *Benefits, *Water quality control, Waste water treatment, Sewage treatment, Downstream, Costs, Simulation analysis, Optimization.

Using the downstream, collective sewage treatment costs, which are avoided, as the measure of the flow augmentation benefits, simulation and optimization techniques were employed to determine the optimal mix of augmentation dur to compare the s throughout the pr portion of the low (b) the unit cost the quantity desir distribution was for ments. Then the r pared with the ar W73-03242

A BRANCH-ANI Karlsruhe Univ. Siedlungswasserv P. M. Meier. In: Proceedings of Association for Research and its: 5, p 355-362, Aug fig, 13 ref.

Descriptors: *Wa posal, *Econo tion, Operations r

A Branch-and B Fortran) was for multi-facility loca costs of treatme objective function tional mathema Despite some sim tion problem of t the additional pr tion costs with fi explicit inclusion terceptor networ used to discretiz enumeration bedeveloped to loca Computational ex rather than conve optimal time-cap gional wastewat Cornell) W73-03243

06. WATER PLANNIN

6A. Techniq

MULTIRESERV IN WATER QUA Saskatchewan-N For primary bibli W73-02664

IMPROVED R HDR Systems, O E. T. Foster, Jr., O. Isu. Water Resourc

Resources Asso October, 1972. 2

Descriptors: *W basins, Manager

WATER RESOURCES PLANNING-Field 06

Techniques of Planning-Group 6A

the optimal mix of wastewater treatment and flow the optimal mix of wastewater treatment and flow augmentation during the critical period specified as design conditions. This analysis was extended to compare the savings in wastewater treatment costs with the expected cost of flow augmentation throughout the project life. The expected cost of flow augmentation was determined by analyzing a portion of the low flow frequency function for two cases: (a) a single unit cost for additional flow; and (b) the unit cost of additional flow; and other quantity desired. The expected value of the distribution was found by using the method of moments. Then the resultant expected cost was compared with the anticipated savings in wastewater treatment costs. (Veverka-Cornell)

A BRANCH-AND-BOUND ALGORITHM FOR REGIONAL WATER QUALITY MANAGE-MENT, Karlsruhe Univ. (West Germany). Institut fuer Siedlungswasserwirtschaft.
P. M. Meier.

P. M. Meier. In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 355-362, August 29-3 September 1970. 8 p, 1 fig, 13 ref.

Descriptors: *Water quality control, *Waste water disposal, *Economies of scale, *Costs, Optimiza-tion, Operations research, Time planning, identifiers: Warehouse location problem.

A Branch-and Bound algorithm (programmed in Fortran) was formulated to solve the non-linear, multi-facility location problem occurring in the op-timization of regional water quality control facili-ties, for which the scale economies and set-up costs of treatment facilities resulted in concave objective functions not susceptible to conven-tional mathematical programming techniques. Despite some similarities to the Warehouse Location problem of the operations research literature, the additional presence of non-linear transporta-tion costs with fixed charges and the necessity of explicit inclusion of intermediate nodes in the in-terceptor network demanded a different solution approach. The single assignment property was used to discretize the problem, and an implicit enumeration branch-and-bound search was developed to locate the optimum feasible solution. Computational experience suggested further effort in the direction of structured search algorithms rather than conventional programming to solve the optimal time-capacity expansion problem of re-gional wastewater disposal facilities. (Veverka-Cornell) W73-03243

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

MULTIRESERVOIR ANALYSIS TECHNIQUES IN WATER QUANTITY STUDIES, Saskatchewan-Nelson Basin Board, Regina. For primary bibliographic entry see Field 04A. W73-02664

IMPROVED RIVER BASIN UTILIZATION THROUGH SYSTEMS ANALYSIS, HDR Systems, Omaha, Nebr.

E. T. Foster, Jr., T. C. Chen, J. P. Newton, and E. O. Isu.

Water Resources Bulletin, American Water Resources Association, Vol 8, No 5, p 863-870, October, 1972. 2 fig, 3 tab, 18 equa, 14 ref.

Descriptors: *Water distribution (Policy), *River basins, Management, Operations, Facilities, Op-

timization, "Linear programming, "Montana, "Missouri River basin, "Decision making, Systems analysis, Mathematical models, Reservoirs, Diver-sion structures, Dams, Constraints, Equations, Identifiers: Objective functions, "Marias River basin *Milit River hasin basin *Milk River basin.

Theoretical and practical results are examined for a study to determine optimal water resource allocation in the 30,000-square-mile Montana North Central Conservancy District. The district covers several river basins and contains numerous exist-ing and proposed facilities (dams, reservoirs, and diversion canals). The study determined the operation of all these facilities along with the sizing of the proposed facilities in order to optimize given objective functions. Related efforts in optimal river basin utilization were surveyed, an programming was selected as an expedient op-timization technique. Herein, the problem is for-mulated by identifying time stages which together municed by heenitying time stages which together constitute a repetitive cycle such as a year. With these stages, it is possible to associate operational and capacity variables with network components, which are branches or nodes. Objective functions are assembled for the component variables. Constraint equations are written in terms of the variables to reflect network nodal continuity, capacity restrictions, and adjudications such as water rights. A numerical example is considered in which the existing and proposed facilities are aggregated to produce a small, tractable number of facilities. Linear programming is shown to be quite feasible as a decision making technique for optimum water resource utilization. (Bell-Cornell)

FLOOD CONTROL STORAGE ALLOCATIONS BY LINEAR PROGRAMMING.

New York State Dept. of Environmental Conser-vation, Albany. Bureau of Water Resources Planning.

For primary bibliographic entry see Field 04A. W73-02667

OPERATION OF SERIALLY-OPTIMAL LINKED WATER RESERVOIRS, California Univ., Los Angeles. School of Engineering and Applied Science.
For primary bibliographic entry-see Field 04A. W73-02707

THE RIVER BASIN MODEL: THE SOCIAL SCIENCE LABORATORY. Envirometrics, Inc., Washington, D.C. For primary bibliographic entry see Field 06B. W73_02853

MATHEMATICAL MODELS FOR REGIONAL ECONOMIC AND WASTE LOAD PROJEC-Environmental Protection Agency, New York. Data Systems Branch. For primary bibliographic entry see Field 05B. W73-02920

DISCOUNT RATES FOR PUBLIC INVEST-DISCOUNT RATES FOR PUBLIC INVEST-MENT UNDER UNCERTAINTY, Norwegian School of Economics and Business Administration, Bergen. For primary bibliographic entry see Field 06B. W73-02942

SYSTEMS ANALYSIS AND WATER QUALITY MANAGEMENT, Manhattan Coll., Bronx, N.Y. Dept. of Civil Enincering. For primary bibliographic entry see Field 05G. 02943

A COMPUTER SIMULATION MODEL FOR FLOOD PLAIN DEVELOPMENT, PART 1: LAND USE PLANNING AND BENEFIT LAND USE PLANNING AND BEALE EVALUATION, INTASA, Menio Park, Calif.
For primary bibliographic entry see Field 04A.

APPLICATION OF A DIGITAL HYDROLOGIC SIMULATION MODEL TO AN URBANIZED WATERSHED, Clemson Univ., S.C. Water Resources Research For primary bibliographic entry see Field 02A.

A METHODOLOGY FOR ESTIMATING THE BENEFITS TO IRRIGATED AGRICULTURE FROM INCREASED ACCURACY SEASONAL STREAMFLOW FORECASTS, Michigan Univ., Ann Arbor. For primary bibliographic entry see Field 03F. W73-03130

SYSTEMS APPROACH TO PROBLEMS OF WATER POLLUTION CONTROL, Michigan Univ., Ann Arbor. School of Public Health For primary bibliographic entry see Field 05G. W73-03222

SYSTEMS APPROACHES TO MICROSCALE PROBLEMS OF WATER POLLUTION CON-TROL. Texas A and M Univ., College Station. Dept. of Industrial Engineering.
For primary bibliographic entry see Field 05G.

SYSTEMS APPROACH TO WATER POLLU-TION CONTROL - A DISCUSSION,
Pennsylvania Dept. of Environmental Resources, Harrisburg, Bureau of Sanitary Engineering, For primary bibliographic entry see Field 05G. W73-03224

THE MIAMI CONSERVANCY DISTRICT EX-PERIENCE IN THE SYSTEMS APPROACH TO WATER QUALITY IMPROVEMENT, Miami Conservancy District, Dayton, Ohio. For primary bibliographic entry see Field 05G.

DEVELOPMENT OF WATER RESOURCES OF A BASIN TAKING ECONOMIC ASPECTS INTO ACCOUNT: PECULIARITIES OF INVESTIGA-TION OF PRACTICAL IRRIGATION PROBLEMS. Institut Gidrodinamiki, Novosibirsk (USSR). For primary bibliographic entry see Field 03F. W73-03226

SOME PROBLEMS OF THE OPTIMAL USE OF A BASIN WATER RESOURCES ON THE BASIS OF MATHEMATICAL MODELLING, Akademiya Nauk Gruzinskoi SSR, Tiflis, Institut For primary bibliographic entry see Field 04A. W73-03227

OPTIMIZATION OF BASIN WATER RESOURCES UTILIZATION, Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Institut Energetiki. ary bibliographic entry see Field 04A. W73-03228

Field 06—WATER RESOURCES PLANNING

Group 6A-Techniques of Planning

THE ADRIA (MONFALCONE) - DANUBE BASIN INTERNATIONAL WATERWAY, Vodogradbeni Laboratorij, Ljubljana (Yugoslavia). For primary bibliographic entry see Field 04A. W73-03230

AN ALTERNATIVE APPROACH FOR FINDING OPTIMAL CONTROL RULES OF RESERVOIR

OPTIMAL CONSTRUCTION OF CIVIL Engineering; and North Carolina Univ., Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 04A.

SOME CHARACTERISTICS AND APPLICA-TIONS OF MATHEMATICAL PROGRAMMING MODELS IN WATER RESOURCE SYSTEMS, Meta Systems, Inc., Cambridge, Mass.

In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol. 5, p 315-323, 29 August-3 September 1970. 9 p, 23 ref.

Descriptors: *Mathematical models, *Water resources development, *Linear programming, *Stochastic processes, Systems analysis, Opera-tions research, Computer programs, Planning.

This paper focuses on the applications of linear (and non-linear) programming with special emphasis on the deterministic and/or stochastic characteristics of models. Since mathematical programming models useful in water resource systems analysis could be classified into a number of overlapping subsets, it was useful to make such distinctions as linear/non-linear single/multi-purpose, integer/continuous, convex/non-convex, design/operating, and deterministic/stochastic. In applying mathematical programming models to systems with explicit stochastic characteristics, various mechanisms were employed to produce a quasi-equivalent deterministic programming problem. Three such mechanisms were discussed by example: (1) an ad hoc deterministic model; (2) a chance constraint model; and (3) a linear programming under uncertainty model. (Veverka-Cornell) W73-03232

PRELIMINARY ANALYSIS OF SURFACE WATER AVAILABILITY,
Saskatchewan-Nelson Basin Board, Regina.
For primary bibliographic entry see Field 04A.

GREAT LAKES SIMULATION MODEL--A DECISION AID, Department of Energy, Mines and Resources, Cornwall Ontario). Great Lakes-St. Lawrence Study Office.

For primary bibliographic entry see Field 02H. W73-03234

W73-03233

STOCHASTIC ANALYSIS OF HYDROLOGIC SYSTEMS, Illinois Univ., Urbana, Hydrosystems Lab.

For primary bibliographic entry see Field 02A. W73-03235

APPLICATION OF HYDROLOGIC SIMULA-TION TO WATER RESOURCES PLANNING, Hydrocomp International, Palo Alto, Calif.

George Fleming.

In: Proceedings of 14th Congress of International
Association for Hydraulic Research, Hydraulic
Research and its Impact on the Environment, Vol
5, p 257-264, 29 August-3 September 1970. 8 p, 7
fig, 18 ref.

Descriptors: *Hydrologic aspects, *Simulation analysis, *Water resources development, Planning, Computer models, Flood forecasting, Flood plains, Vegetation, Rainfall-runoff relationships, Systems analysis.

This review paper presents a brief discussion of current computer oriented techniques with the critical viewpoint that it should be suitable for applied water resources planning and operation. This viewpoint was adopted since the progress of any research tool would be accelerated by applying it to the 'real' problem. The main theme of the paper was the presentation of several examples showing the successful application of one specific model to widely divergent aspects of applied water resources. These included flood forecasting, flood plain management, flood frequency, urban hydrology and vegetation management. The rainfall-runoff problem was used to illustrate how modern computer techniques were useful in planning and operating water resources projects. modern computer techniques were useful in planning and operating water resources projects. The following problems were dealt with before computer models could be applied to water resources problems: (1) computer availability, (2) program compatability with hardware, (3) availa-bility of experienced personnel, and (4) availability of well documented programs or training facilities. (Yeverka-Cornell) W73-03236

MATHEMATICAL MODELS AND THEIR USE IN WATER RESOURCES DECISION-MAKING,
Department of Fisheries and Forestry, Ottawa
(Ontario). Inland Waters Branch.

(Ontario), initiand waters Branch.
A. K. Biswas.
In: Proceedings of 14th Congress of International
Association for Hydraulic Research, Hydraulic
Research and its Impact on the Environment, Vol
5, p 241-248, 29 August-3 September 1970. 8 p, 23

Descriptors: *Mathematical models, resources (Development), *Decision Mathematical models, Optimization, systems analysis, Constraints, Simulation analysis, Identifiers: *Saint John River system.

Mathematical modelling was described as a problem solving technique wherein attempts were made to build replicas of real world systems or situations. Models were divided into two categories: programming and descriptive. Programming models derived the optimal policy for a given ob-jective function whereas descriptive models prejective function whereas descriptive models pre-dicted the values of endogenous variables for a given set of exogenous variables. These models significantly aided the decision-maker by broaden-ing his information base, by predicting the con-sequences of several alternative courses of action, sequences of several alternative courses of action, or by selecting a suitable course of action which would accomplish a prescribed result. Six basic considerations to the art of model building were: (1) objectives of the system, (2) environment of the system (constraints), (3) components of the system (goals and interrelationships), (4) resources of the system, (5) criteria for measuring the objectives of the system and the goals of the subsystems, and (6) optimal management of the total system. The fundamental aspect of any decision-making process was the participation of those who might be affected by the decision itself. The policy implictions of the mathematical model developed for the Saint John River system of Canada were discussed. (Veverka-Cornell)

SYSTEMS APPROACH TO REGIONAL WATER USE AND DEMAND,
Department of Fisheries and Forestry, Ottawa

(Ontario). Inland Waters Branch.

P. J. Reynolds.
In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol

5, p 293-299, 29 August-3 September 1970. 8 p, 1 tab. 25 ref.

Descriptors: *Systems analysis, *Water utiliza-tion, *Water demand, *Water supply, Time, Costs, Optimization, Forecasting, Decision mak-

Using the Saskatchewan-Nelson Water supply Using the Saskatchewan-Nelson Water supply Study as an example, the question of how to undertake a study of water use and demand in a reasonable period of time and at a reasonable cost was the focus of this paper. Demands were determined as a function of the price to be paid for water, i.e., for the range of costs of delivery. The assessment identified the influence of water pricagon demand is a the absticity of demand for incomplement is a the absticity of demand for incomplement is the satisficity of the man of the satisficity of ing on demand, i.e., the elasticity of demand for iring on cemand, i.e., the easticity of demand for irgation, water supply, hydro power, waste dilution, recreation, navigation, fish and wildlife, industrial supply and cooling and other uses. Technological changes in terms of process and recycling were also taken into account. The essentiation of the control of the control of the count. recycing were asso tacted into account. In control titled step in the water demand forecasting process were (1) Regional Economic Base study; (2) identification of relevant variables relating to each identification or relevant variables resamp to each water demand and analysis of their trends over time; (3) analysis of alternative ways of meeting demands (i.e., supply functions), and (4) comparison of demand and supply functions and iteration to revise (1), (2), and (3) as necessary. Basically water demand forcerative served two served two cally water demand forecasting served two pur-poses. One was for rough estimates to provide a range of possible 'answers' for broad, preliminary cy decisions of preliminary screening of projects. The other was with respect to investment decisions within specific regions. (Veverka-Cornell) W73-03238

ON THE OPTIMIZATION OF THE DESIGN OF STORAGE AREAS AT RIVER DAMS, Technische Hochschule, Munich (West Germany). For primary bibliographic entry see Field 04A.

PROGRAMMING MODEL OF REGIONAL WATER QUALITY MANAGEMENT, California Univ., Berkeley. Dept. of Industrial Engineering and Operations Research. For primary bibliographic entry see Field 05G. W73-03240

DATA COLLECTION FOR WATER SYSTEMS CONTROL, Arizona Univ., Tucson

For primary bibliographic entry see Field 07C. W73-03241

A BRANCH-AND-BOUND ALGORITHM FOR REGIONAL WATER QUALITY MANAGE-

MENT, Karlsruhe Univ. (West Germany). Institut fuer Siedlungswasserwirtschaft.
For primary bibliographic entry see Field 05G.
W73-03243

EFFECT OF RESERVOIR DRAWDOWN ON OP-TIMAL OPERATION,
Virginia Polytechnic Inst. and State Univ.,
Blacksburg, Va. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W73-03244

PROBLEM-ORIENTED COMPUTER RUBLEM-UNIENTED COMPUTER LANGUAGES IN HYDRAULIC ENGINEERING: A BRIEF OVERVIEW OF THEIR EVOLUTION, STATE OF THE ART AND FUTURE, Illinois Univ., Chicago. Coll. of Engineering. For primary bibliographic entry see Field 07C. W73-03245

6B. Evaluation

PUBLIC ATTITUE RECLAIMED WAT California Univ., Center. For primary bibliogr W73-02601

A COMPARISON O ADMINISTRATOR AN OUTDOOR WA

AN OUTDOOR WAREA,
Pennsylvania State
for Research on Lan
C. D. Price, and H. E
Available from the
tion Service as PB-\$0.95 in microfiche 1972, 175 p, 6 fig, 24 B-025-PA (1).

Descriptors: *Recre *Water quality, Aesthetics, *Attitus *Pennsylvania, *Soc Identifiers: Perception

Visual perceptions based recreation a stratified random sa sidents and compare resource administra administer resource Pennsylvania. Resu citizens do not gene qualities in an oppo-administrators. The characteristics (age, income) were tested significant effect on participants and we minor impact. To showed a higher of homogeneity in their respondents. Both components of an o when evaluating suc on how they shou between the public be a function of or terested in the enviro ing personal needs ceived from a profes tion point of view. W73-02612

EFFECTS OF RESIDENCE ON RECREATE Virginia Polytechn Blacksburg. Dept. of P. H. King. Available from the tion Service as PB-\$0.95 in microfiche Research Center Co 33 p, 3 fig, 6 tab. OW

Descriptors: *Reser *Recreation, Composeservoirs, Model

In recent years the multiple purpose wa increased dramatical very nature, the be such projects from have been extremely the factors that affe fluctuation in the wa This research was making available to t

improved tool for in

. Evaluation Process

BLIC ATTITUDES TOWARD REUSE OF CLAIMED WATER,
ifornia Univ., Berkeley. Water Resources

primary bibliographic entry see Field 05D. 3-02601

COMPARISON OF PUBLIC AND RESOURCE MINISTRATOR VISUAL PERCEPTIONS OF OUTDOOR WATER-BASED RECREATION EA.

EA, msylvania State Univ., University Park. Inst. Research on Land and Water Resources.

D. Price, and H. B. Gamble. illable from the National Technical Informatiservice as PB-213 467, \$3.00 in paper copy, 5 in microfiche. Completion Report, August 2, 175 p. 6 fig, 24 tab, 88 ref, 6 append. OWRR 25-PA (1).

criptors: "Recreation, "Recreation facilities, ater quality, "Administration, "Planning, thetics, "Attitudes, Scenery, Environment, masylvania, "Social values.

ntifiers: Perception.

ual perceptions regarding a fictitious watered recreation area were recorded from a
tified random sample of 392 Pennsylvania reents and compared with the perceptions of 42
ource administrators who allocate, develop, or
ninister resources for public recreation use in
nasylvania. Results ahowed that Pennsylvania
zens do not generally perceive environmental
dities in an opposite manner from the resource
ninistrators. The effects of five demographic
racteristics (age. sex. income. residency, and racteristics (age, sex, income, residency, and ome) were tested to determine if they had any ome) were tested to determine if they had any ificant effect on the perceptions of the public ticipants and were found to have only a very nor impact. The resource administrators wed a higher degree of sophistication and nogeneity in their response than did the public pondents. Both groups agreed closely on the nponents of an outdoor water-based recreation rironment that were most important to them en evaluating such an area, but could not agree how they should be evaluated. Differences ween the public and administrators seemed to a function of orientation. The public was inested in the environment for its utility in satisfy-personal needs while the administrators perved from a professional or resource administrapionist of view.

3-02612

FECTS OF RESERVOIR OPERATING POL-

YON RECREATION BENEFITS, ginia Polytechnic Inst. and State Univ., cksburg. Dept. of Civil Engineering.

casourg. Dept. of civil engineering.

4. King.
ailable from the National Technical Informan Service as PB-213 509, \$3.00 in paper copy,
95 in microfiche. Virginia Water Resources
search Center Completion Report, August 1972.
p, 3 fig. 6 tab. OWRR B-009-VA (2).

scriptors: *Reservoir operation, *Water levels, ecreation, Competing uses, *Multiple purpose ervoirs, Model studies, *Optimum develop-nt plans.

recent years the attention given recreation in ltiple purpose water resource development has reased dramatically. However, because of their reased dramatically. However, because of their y nature, the benefits and losses accruing to the projects from recreation, or the lack of it, we been extremely difficult to quantify. One of factors that affects recreation benefits is the cuation in the water level of the impoundment. is research was undertaken with the goal of king available to the water resources planner an proved tool for including a realistic recreation benefit-loss function in the development of a model to determine optimum reservoir operation policy. Primary attention was given to reservoirs whose water levels changed appreciably during the recreation season, but data from reservoirs that were not drawn down were also collected in order were not drawn down were also collected in order to maintain a control, so that relevant conclusions could be drawn. Background information including the normal levelof recreation activity, accessibility of the area to centers of population, weather patterns, topographic features, and other data pertinent to specific cases were also gathered. A computerized analysis was developed in order to quantify the results and to draw conclusions on the least of distals of the foreast developed from the basis of statistical inferences developed from the data. For the reservoirs which showed widely fluctuating water levels, no statistically significant relationship was shown to exist between water level and recreation attendance for the month of July for the nine year period, 1958-66. (Morgon-Virginia) W73-02618

WATER RESOURCES MANAGEMENT IN DELAWARE,
Delaware Univ., Newark. Water Resources

Center.

F. Tannian, G. A. Loessner, and William Habacivch

Available from the National Technical Informa-Available from the National Technical Informa-tion Service as PB-213 510, \$3.00 in paper copy, \$0.95 in microfiche. Research Project Technical Completion Report, Spring 1972. 20 p. OWRR A-013-DEL (1). 14-01-0001-3008.

Descriptors: *Water management (Applied), Economics, Water demand, *Benefits, *Legal aspects, *Costs, *Sewage, Social aspects, Economic efficiency, *Use rates, *Delaware, Administration, *Water policy.

The first section of the report presents basic economic concepts and suggests relationships to Delaware water management. Water and sewer services are interrelated. Costs, user benefits and pricing policies for these services have an impact on users and so should be considered by governmental water managers. Externalities of costs and benefits create important public management responsibilities. An information system emphasizing economic elements is presented. The second section uses economic principles to evaluate exist-ing policy and legal arrangements of the Delaware Division of Environmental Control. Suggestions for some policy modifications are presented. The third section reviews water management policies of the Delaware Public Service Commission. The structure, conduct and behavior of the Commission are examined. Policies affecting pricing, rate structures, investment and costs are emphasized. W73-02622

WATER RESEARCH AT THE UNIVERSITY OF CONNECTICUT.

Connecticut Univ., Storrs. Inst. of Water Resources. For primary bibliographic entry see Field 09A. W73-02631

A SIX-YEAR REVIEW. New Hampshire Univ., Durham. Water Resources Research Center. For primary bibliographic entry see Field 09A. W73-02655

INTEGRATED MANAGEMENT OF QUANTITY AND QUALITY OF URBAN WATER RESOURCES, Texas A and M Univ., College Station. Dept. of Industrial Engineering. For primary bibliographic entry see Field 05G.

W73-02666

ENVIRONMENTAL BENEFIT-COST ANALYSIS FOR NUCLEAR POWER GENERATION, Battelle Memorial Inst. Columbus, Ohio.

D. L. Morrison. Nuclear News, Vol 15, No 6, p 50-57, June 1972. 2 fig, 3 tab, 13 ref.

Descriptors: *Environmental effects, *Benefit-cost analysis, *Decision making, Project planning, Project benefits, Benefit-cost theory, Nuclear Project benefits, Benefit-cost theory, Nuclear energy, Social aspects, Psychological aspects, So-cial impact, Economic impact, Methodology, "Nuclear powerplants. Identifiers: National Environmental Policy Act,

Site selection

Interpretations of the National Environmental Policy Act require environmental reports for nuclear powerplants to include benefit-cost analysis. Such powerplants to include benefit-cost analysis. Such analysis is a management tool used in decision-making to assess desirability, but with environment as a factor, the decisionmaker must rely even more on informed judgments. Three basic complexities presented and commented upon are: (1) definition of a baseline-not clear; (2) qualifying the nature of impacts-not certain; and (3) quantifying these impacts-virtually impossible on a consistent basis. The general considerations of siting a specific nuclear power station and all reasonable sistent basis. The general considerations of sting a specific nuclear power station and all reasonable alternatives are presented. Issues of site selection, energy mix, and environmental-resource utilization are considered. Reduction of issues to a common base for comparison is the major methodological gap. Improvement may be expected as greater understanding is gained of society's evaluation of environmental characteristics. The environmental convironmental characteristics. The environmental considerations for Commonwealth Edison's LaSalle County Station, Ill., are presented to ex-emplify the benefit-cost analysis to electric power generation; tables for comparisons of alternatives are given. (USBR)

THE RIVER BASIN MODEL: THE SOCIAL SCIENCE LABORATORY. Envirometrics, Inc., Washington, D.C.

Available from Sup Doc as EP1.16: (16110FRU 12/71/12), price \$2.00, and also available from the National Technical Information Service as PB-213 657, \$0.95 in microfiche. Prepared for: Office of Research and Monitoring, U.S. EPA. Water Pollution Control Research Series Project 16110 FRU, Contract 14-12-959, December, 1971. 270 p, 29 fig, 15 tab, 309 ref. EPA 16110 FRU 12/71/13.

Descriptors: "Urban sociology, "Education, "Regional analysis, "Decision making, "Computer models, Computer programs, Social aspects, Political aspects, Governments, Economics, Water resources. Identifiers: Gaming-simulation

The RIVER BASIN MODEL delineates an entire regional system and its interaction with water, one of its subsystems. Presented is a gaming-simulation, City Model, designed by individuals who later founded Environmetrics, Inc., to provide college-level social science students with an educational transfer according to the contract according to the co tional technique which reverts to a more personal-ized education (computer assisted laboratory) and at the same time allows society to remain at the same time allows society to remain undisturbed by the learning process. Students are interested in actively participating in the solutions of our social ills. In the model, participants are decision-makers in one of three sectors: economic, social or governmental. A starting scenario briefly describes problems, issues, growth characteristics, housing, schools, etc. in

Field 06-WATER RESOURCES PLANNING

Group 6B—Evaluation Process

the simulated metropolitan area. When the model is underway, the characteristics of the city will reflect the actions and interactions of the partici-rants. The computer records participant decisions reflect the actions and interactions of the participants. The computer records participant decisions for each round and regularly provides printouts showing the interaction of decisions and their interaction of decisions and their interaction of the participant in the model will respond to, and the play can be enhanced by, a nearly infinite variety of player actions generated by curiosity, magination, innovation or planning, programming, and budgeting. The City Model is described in detail and full reports of its successful implementation in several American colleges are presented. (Bell-Cornell)

COMMUNITY VALUES: A STRATEGY FOR PROJECT PLANNING, Massachusetts Inst. of Tech., Cambridge. M. L. Manheim, and J. H. Suhrbier. Highway Research Record, No 380, p 37-47, 1972.

Descriptors: *Project planning, Social values, Environmental effects, *Transportation, Highways, Locating, Systems analysis, Cities, Decision making, Political aspects, Highway effects, Economic impact, Urban areas, Human behavior, Social aspects, Social impact, Social participation, Locations

Identifiers: *Community agreement, Alternatives, Environmental evaluation.

A proposed strategy for project planning, location, and design, with emphasis on community values and other related social and environmental factors, is described for transportation projects. Seven aspects of the location-design process are discussed, stressing relationships with interest cuscussed, stressing relationships with interest groups, fairness to all groups affected, negotia-tions, and the decision process. The location team must achieve substantial community agreement on a course of action; 8 guides for success are given. The strategy for planning considers: (1) objective of the location-design process; (2) situation dynamics, including survey, analysis, design and negotiation, and ratification; (3) roles, activities, and organizational structure for the propiect study and organizational structure for the project study and organizational structure for the project study team; (4) dangers as perceived by the responsible agency and the community; and (5) applicability of system planning and public policy programs. The strategy was developed specifically for project-level decisions. (USBR) W73-02834

THURSTON COUNTY, A COMPREHENSIVE WATER AND SEWERAGE PLAN, VOLUME II, WATER PLAN. Cornell, Howland, Hayes and Merryfield, Seattle,

For primary bibliographic entry see Field 06D. W73-02865

WATER REQUIREMENTS OF SANTA BAR-BARA COUNTY, 1967 TO 1999, Bookman and Edmonston, Glendale, Calif. For primary bibliographic entry see Field 06D.

WATER AND OUR FUTURE: AN URBAN PLANNING MANUAL FOR LOCAL OFFI-

CIALS, National Association of Counties Research Foun-

National Association of Counties Research Foundation, Washington, D.C.
P. Mummert, M. Simmons, and M. Gemmell.
Available from the National Technical Information Service as PB-213 739, \$5.45 paper copy, 30.95 in microfiche. Completion Report, May 1972, 104p. OWRR C-2136 (No. 34-02) (1).

Descriptors: *Planning, *Urbanization, *Local governments, Water resources development, *Institutions, *Water policy, Administration, Coordination, Decision-making, Social aspects.

Identifiers: Counties, Local elected officials, Related planning programs, Public support, Financial assistance, Technical assistance.

The report attempts to define the role of local elected officials in the water resources planning process. It examines that process from the perspective of the local policy making official. Effective policies that have been conducted by various water resources agencies and organizations, both public and private. Experiences gained by local governments in their attempts to develop and implement both local and regional responses to water and the future are described. The ramifications of the water resources problem are defined along with an outline of the local elected official's role in the formulation of water resources decisions, policies, plans, and programs. The resources, constraints and options available to the local officials in the development of sound local and areawide water resources planning and management programs are discussed. Extensive on-site studies were made in eleven metropolitan areas. Although many of the tarset metropolitian areas exhibit exe report attempts to define the role of local grams are discussed. Extensive on alle studies were made in eleven metropolitan areas. Although many of the target metropolitan areas exhibit exceptional roles in the field of water resources planning, the research team attempted to interpret these roles into general terms, encouraging univer-sal applicability. W73-02872

TECHNOLOGY TRANSFER IN WATER RESEARCH-THE INTERFACE BETWEEN PRODUCERS AND USERS.
Nebraska Univ., Lincoln. Water Resources

Available from the National Technical Informa-Available from the National Technical Informa-tion Service as PB-213 740, \$6.00 in paper copy, \$0.95 in microfiche. Proceedings of Conference on Technology Transfer in Water Research, Sep-tember 25-26, 1972, Lincoln, Nebraska. Research Institute Publication, 1972. 167p. OWRR A-999-NED (11)

Descriptors: "Water resources development, "Information exchange, "Technology, "Conferences, Research and development, Environmental control, Reviews, Weather modification, Planning, Engineering, Geothermal studies, Water quality control, Remote sensing, Coasts, Publications, Data processing, Methodology, Federal government, Interagency cooperation, Universities, Water resources institute.

Identifiers: "Technology transfer.

This conference on Technology Transfer in Water Ints conterence on Technology Iranster in water Resources' held in Lincoln, Neb, Sept 25-26, 1972, was supported in part by the Office of Water Resources Research, Department of the Interior, under the Public Law 88-379 program. The con-ference was designed to bring together research producers and users from universities, state and federal associate and other comprisations. The ference was uesigned to the composition of the producers and users from universities, state and federal agencies and other organizations. The Proceedings are presented to serve as a useful guideline for the development of user-oriented research programs which successfully incorporate the important mission of technology transfer. The main topics for panel and workshop discussions include: (1) the state of water technology transfer deficiencies in current programs and positive suggestions for improvement; (2) what are water resources research institutes doing about transfer; (3) ways to overcome barriers technology transfer; (3) ways to overcome barriers between research users and producers; (4) procedures for developing effective technology transfer programs; and (5) ways to involve the user in the design and conduct of research projects. (See W73-02878 and W73-02879) (Woodard-USGS) W73-02877

THE IMPORTANCE OF A PRACTICAL RESEARCH INPUT TO WATER RESOURCES DEVELOPMENT, Bureau of Reclamation, Denver, Colo.

In: Proceedings of Conference on Technology Transfer in Water Research, September 25-26, 1972, Lincoln, Nebraska: Nebraska University Water Resources Research Institute Publication, p Pescriptors: "Water resources development, "Projects, "Research and development, "Federal government, "Reviews, Weather modification, Planning, Engineering, Geothermal studies, Water quality control, Colorado River, Remote sensing, Irrigation, Costs. Descriptors: *Water resources development

tifiers: Bureau of Reclamation.

In fiscal year 1972 the Bureau of Reclamation invested about \$11 1/2 million for research and development in water resources. The largest program was weather modification, with an expenditure of over \$6.6 million, followed by a \$3 million program for water resource planning and engineering research. About \$\$50,000 was used in geothermal studies. The Colorado River Water Quality Improvement Program had funds of \$440,000, and research studies sponsored by regional office required over \$420,000. Some \$100,000 was spen or remote sensing studies, and about \$50,000 was on remote sensing studies, and about \$50,000 was devoted to quality of water investigations. Highlights of the research activities are described. (See also W73-02877) (Woodard-USGS)

THE TRANSFER OF WATER RESEARCH OUT-PUT BY THE ENVIRONMENTAL PROTEC TION AGENCY.

Environmental Protection Agency, Washington,

R. E. Crowe. In: Proceedings of Conference on Technology Transfer in Water Research, September 25-26, 1972, Lincoln, Nebraska: Nebraska University Water Resources Research Institute Publication,

Descriptors: *Environmental control, *Federal government, *Information exchange, *Research and development, *Water resources development, Technology, Publications, Conferences, Data processing, Methodology.

Identifiers: *Technology transfer, *Environmental Protection.

Protection Agency.

The term 'technology transfer' has different ne term technology transfer has different meanings in various agencies throughout the federal government. The Environmental Prote-tion Agency's technology transfer program is designed to: (1) influence the construction, installation and operation of pollution control and abate ment facilities; (2) insure that the latest viable technologies are transferred to the potential user of these technologies; and (3) eliminate the potential for large investment in obsolete facilities. The program's primary function is to bridge the gap between research and full-scale use by evaluating between research and full-scale use by evaluating and transferring newly developed successful technologies to consulting engineering firms; minicipal, industrial and state design engineers; city directors of public works; industrial managers; conservation groups; academic groups; and other exerting influence on the design and construction of pollution control facilities. A further goal is to nationally establish the newly emergent technologies as practical and feasible alternatives so that they will be routinely considered and evaluated is planning facilities. The objective of disseminating the latest practical pollution control technological the latest practical pollution control technological alternatives to all potential users is accomplished through seminars, technical and semi-technical publications, audio-visual media and exhibits. (Set also W73-02877) (Woodard-USGS)

AN ECONOMIC ANALYSIS OF WATER-US REGULATION IN THE CENTRAL OGALLALI FORMATION,
Oklahoma State Univ., Stillwater. Dept. of
Agricultural Economics.

For primary bibliog W73-02892

NALYSIS OF TE ANALYSIS OF TEOF FUEL POLICY
TION OF ANOTE
AID OF A COMPU
Naval Postgraduate
For primary bibliog
W73-02908

PRE-IMPOUNDM THE SAYLORVIL Iowa Cooperative R. E. Lenning.
Proceedings of the Vol 77, p 47-54, 197

Descriptors: *Rese impoundment, *Re ing, Fishing. Identifiers: Recres

Recreation use pa ville reservoir area Polk County, Iowa to December, 1969 impoundment cond formation against in recreational use lapse movie came and direct observa tional use patterns Because of low wand canoes made u craft. An increase during high river fl Most boating took afternoons. Questi cent of the boates: cation, and 76 pe \$7,000. Boating an related. Of the 58 their second choic area was light. Thu new impoundmen (Settle-Wisconsin) W73-02912

A NEW THEORY MAKING FOR P Florida Univ., Ga Economics. E. Loehman, and **Purdue University** Administration Re

Descriptors: *Util ciency, *Welfare Optimization, Eco ment, Mathematic Identifiers: *Incre pricing, Pure publi

from The Bell Jou ment Science, Vo 1971. 6 fig, 21 ref.

A theory of prior presented. The pr on the idea of each mental costs due to aental-cost charge tional service once fixed and plant c must pay the incre tional demand. Su following properti are covered, even users with the sam same charge; (3) the incremental c or primary bibliographic entry see Field 04B.

NALYSIS OF THE EFFECTS ON OIL SPILLS F FUEL POLICY CHANGES AND THE ADDI-IF FUEL POLICY CHANGES AND THE ADDI-TION OF ANOTHER FUEL PIER WITH THE ID OF A COMPUTER SIMULATION MODEL, aval Postgraduate School, Monterey, Calif. or primary bibliographic entry see Field 05G. 773-02908

RE-IMPOUNDMENT BOATING ACTIVITY IN HE SAYLORVILLE RESERVOIR AREA, was Cooperative Wildlife Research Unit, Ames. E. Lenning. roceedings of the Iowa Academy of Sciences, of 77, p 47-54, 1970. 3 fig, 2 tab. OWRR A-023-IA

escriptors: *Reservoirs, *Impoundments, *Pre-apoundment, *Recreation demand, Boats, Boat-ig, Fishing. leatifiers: Recreation use, Des Moines River owa).

ecreation use patterns in the proposed Saylor-ille reservoir area along the Des Moines River in olk County, Iowa, were studied from June, 1978, December, 1969. The data, collected under pre-appoundment conditions, will provide baseline in-romation against which to weigh future changes recreational use of the area. Automatic timepse movie cameras, recreation questionnaires, nd direct observation were used to study recreaonal use patterns. The peak period of boating in the area occurred in August and September. ecause of low water levels, flat-bottomed boats ecause of low water levels, flat-bottomed boats and cances made up about 78 percent of total river raft. An increase in large pleasure boats did occur uring high river flow in the early summer of 1969. lost boating took place on weekend and holiday lternoons. Questionnaires indicated that 73 per-ent of the boatees had at least a high-school eduent of the boatees had at least a high-school edu-tion, and 76 percent earned incomes of over 7,000. Boating and fishing activities were closely-lated. Of the 58 people who indicated boating as seir second choice of activity. 48 reported fishing s their first choice of activity. Overall use of the rea was light. Thus, any possible conflict with the ew impoundment can probably be alleviated. Settle-Wisconsin) 773-02912

NEW THEORY OF PRICING AND DECISION-MAKING FOR PUBLIC INVESTMENT, lorida Univ., Gainesville. Dept. of Agricultural

Loehman, and A. Whinston.

. Lochman, and A. Whinston. urdue University Krannert School of Industrial dministration Reprint Series No 390, Reprinted rom The Bell Journal of Economics and Manage-ent Science, Vol 2, No 2, p 606-625, Autumn, 971. 6 fig, 21 ref. OWRR B-020-IND (13).

escriptors: *Utilities, *Prices, *Economic effi-iency, *Welfare (Economics), Marginal costs, ptimization, Economies of scale, Equity, Invest-ient, Mathematical models.

dentifiers: *Incremental costs, Incremental-cost

ricing, Pure public goods.

theory of price-setting in public utilities is resented. The pricing system proposed is based in the idea of each user paying the social incre-nental costs due to his demands. Under this incre-ental-cost charge scheme, if a user desires addi-onal service once the demands of other users are onal service once the demands of other users are ixed and plant capacity is determined, then he ust pay the incremental cost of meeting his addi-onal demand. Such a charge scheme satisfies the blowing properties: (1) total costs of the service re covered, even in decreasing cost industries; (2) sers with the same quantity demands will pay the ame charge; (3) the charge is a function only of he incremental costs due to a user; and (4) the

charge is homogeneous of degree one in the incre-mental costs. By definition, this incremental-cost mental costs. By definition, this incremental-cost scheme satisfies the necessary marginal conditions for social welfare maximization just as marginal-cost pricing does. However, unlike marginal-cost pricing, this scheme covers full costs in the case of increasing returns to scale. The principle of incremental-cost pricing can easily be applied to such problems as the pricing of pure public goods and the determination of what charges to levy to cover plant expansion. (Settle-Wisconsin)

W73-02917

AGGREGATE RETURNS FROM WATER RESOURCE DEVELOPMENT IN GEORGIA.

1946-1965, Georgia Univ., Athens. Dept. of Agricultural

A. Ersoz, and B. R. Miller. Research Report No 133, July, 1972, 32 p. 7 tab. 51

Descriptors: "Water resources development, "Economic impact, "Income, Incremental income, Investment, Cost-benefit analysis, "Georgia. Identifiers: "Corps of Engineers.

Between 1946 and 1965, over \$414 million was spent by the federal government on the developnent of Georgia's water resources. The impact of these investment expenditures on Georgia's in-come is estimated as the difference between gross benefits from the investments and the charges levied upon the residents as a result of the invest-ments. The gross benefits of a particular program to a region are assumed to depend on both the number and cost of the projects constructed in the region and the returns per unit of costs in these projects. The charges or costs levied on the residents of a region to secure the benefits of the program consist of (1) the initial construction costs borne by the region, (2) the present value of future operation, maintenance, and repair costs borne by operation, maintenance, and repair costs some by the region, (3) the region's share of federal taxes used to support the Corps of Engineers national construction program, and (4) the region's share of federal taxes used to finance operation, main-tenance, and repair costs of all the Corps' projects. Georgia's per capita income increased by slightly more than \$100 for the entire period as a result of the Corps' program. (Settle-Wisconsin)

THE GENERAL ECONOMY.

Chase Econometric Associates, Inc., Philadelphia,

For primary bibliographic entry see Field 05G.

ON THE POSSIBILITY OF A MARKET FOR EXTERNALITIES,

Pennsylvania Univ., Philadelphia.

Journal of Political Economy, Vol 80, No 5, p 1039-1044, September/October, 1972. 3 ref.

Descriptors: *Economic efficiency, *Optimization, Prices, Pollutants. Identifiers: *Externalities, *Markets, Public goods, Pollution.

It is sometimes felt that social prices might be It is sometimes tell that social prices might be achieved by 'marketing' externalities. However, a theoretical model is developed to indicate that no such marketing possibilities exist. Efficient resource allocation in a society with interdepenresource allocation in a society with interdepen-dent utilities or externalities requires social prices which lead to the same problems as those for public goods. An externality-laden good can be decomposed into two components: one's own con-sumption (a regular good) and the benefit or harm to others of that consumption (a public good). It is well known that, in the presence of public goods, consumers will fail to reveal their preferences in

order to avoid socially optimal pricing or taxation.

Consequently, individuals who enjoy or endure externalities will try to evade their social responsibility by hiding their true preference. As a result, any attempt to 'market' externalities will undoubseury rail to achieve a social optimum. Further-more, when only one consumer creates a particu-lar externality, he is in a position to operate in a monopolistic manner. Of course, such behavior will create a 'failure' in the market and, again, marketing externalities will fail to achieve a social optimum. (Settle-Wisconsin) W73-02933

LITERATURE REVIEW: ECONOMICS, Rutgers - The State Univ., New Brunswick, N.J. For primary bibliographic entry see Field 05G.

ECONOMIC EFFICIENCY VS. ENVIRONMEN-TAL QUALITY IN SMALL WATERSHED DEVELOPMENT, Purdue Univ., Lafayette, Ind. Dept. of Agricul-For primary bibliographic entry see Field 04D.
W73-02936

ECONOMIC IMPACT OF ANTICIPATED PAPER INDUSTRY POLLUTION—ABATEMENT COSTS, PART I: EXECUTIVE SUMMARY. COSIO, FART I: EXECUTIVE SUMMARY. Little (Arthur D.), Inc., Cambridge, Mass. For primary bibliographic entry see Field 05G. W73-02941

DISCOUNT RATES FOR PUBLIC INVEST-MENT UNDER UNCERTAINTY, Norwegian School of Economics and Business Administration, Bergen.

A. Sandmo. International Economic Review, Vol 13, No 2, p 287-302, June, 1972. 23 ref, 1 append.

Descriptors: *Discount rates, *Investment, Op-timization, Economic efficiency, Mathematical models, *Risks. Identifiers: *Social discount rate, *Public invest-

A microeconomic model is developed for analyzing the problem of efficient allocation of public capital in a world of uncertainty. A definition of Pareto optimality under uncertainty is presented and used as a basis for deriving rules for correct and used as a basis for deriving rules for correct discounting in public investment evaluation. These rules are derived for two forms of market or-ganization. The economy is initially assumed to consist of corporations. Consumers own shares in the firms, and there are markets for the exchange of these shares. A second model assumes that every consumer is also a producer who has access to a bond market but not to a stock market. Thus, firms are unincorporated, and there is no opportunity for diversifying portfolios in the private sector. These models suggest that the public sector's discount rates should always contain a risk margin which corresponds to the margin used in the private sector for investment in the same risk class. In the stock market economy this risk margin can be inferred directly from market data; in the unincorporated economy an averaging of in-dividual risk margins is required. Several difficul-ties with this approach to deriving correct discount rules are indicated. (Settle-Wisconsin)

TOWARDS A PHILOSOPHY OF PLANNING: AN INVESTIGATION INTO ATTITUDES HELD FEDERAL WATER RESOURCE PLAN-NERS,

Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 06E. W73-02955

Field 06-WATER RESOURCES PLANNING

Group 6B-Evaluation Process

AN APPROACH FOR INVOLVING LOCAL OF-TICIALS AND CITIZENS IN REGIONAL WATER QUALITY STUDIES, Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 05G.

MAN AND WATER: A LESSON IN HISTORY, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 03F. W73-03090

FUTURE ENVIRONMENTS OF ARID REGIONS OF THE SOUTHWEST.

Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Colorado Springs, Colorado, May 7-10, 1969. G. L. Bender,

Descriptors: "Arid lands, "Long term planning, "Southwest U.S., "Land use, Land classification, "Land management, Community development, "City planning, Urban hydrology, "Decision making, Political aspects, Social aspects, Legal aspects, Ethics, Deserts, Zoning, Environment, Human population.

The purpose of the symposium, presented at the forty-fifth annual meeting of the Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science, was to establish a nucleus around which future environestablish a nucleus around which future environ-ments in arid lands can be planned. Eight papers are included with the following titles: (1) Future Environments of Arid Lands of Southwestern States, (2) A Land-Use Plán for the Arid Southwest, (3) The Future Human Occupance of the Arid Southwest, (4) Public Land Management in the Arid Southwest, (5) Arid Lands and their Future, (6) Planning Our Urban Environment in the Southwest, (7) New Towns for the Southwest, and (8) Philosophies. Technologies and Architec-and (8) Philosophies. Technologies and Architecand (8) Philosophies, Technologies and Architectures. Objectives of the Committee on Desert and Arid Zones Research of the AAAS are to encourage the study of phenomena affecting (and affected by) human occupation of arid and semiarid regions which includes educational and research activities (fundamental and applied) that may further the understanding and efficient use of arid lands. (See W73-03119 thru W73-03125) (Black-Arizona) W73-03118

FUTURE ENVIRONMENTS OF ARID LANDS OF SOUTHWESTERN STATES, Michigan Univ., Ann Arbor. Biological Station.

D. M. Gates.

In: Future Environments of Arid Regions of the Southwest, Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Sym-posium, Colorado Springs, Colorado, May 7-10, 1969. G. L. Bender, editor. p 1-8.

Descriptors: *Legislation, Political aspects, *Arid lands, *Southwest U.S., Social aspects, *Legal aspects, *Planning, Ethics, *Decision making, Descris, Ecosystems, Ecology, Biomes.

The semiarid region of the southwestern United States is a highly vulnerable, fragile landscape susceptible to irreparable damage by man. Yet it is a landscape of immense beauty, of great recreational potential, and of considerable productive potential. Studies of ecosystems have led the potential. Studies of ecosystems have led the ecologists to enumerate certain ecological laws which aid ability to understand and manage various ecosystems. These laws can be applied directly to management of desert biosnes and to management of modified ecosystems. Five laws are enumerated and discussed, along with the general ecology of the southwestern states. Biomes included in the discussion are the sclerophyll forest, pinon-juniper, chaparral, and desert. A strategy of ecosystem management is outlined which includes the legislation approach to deal with the problems of the environment. (See also W73-03118) (Black-Arizona) W71-03119

A LAND-USE PLOY
SOUTHWEST,
New Mexico State Univ., University Park. Dept.
of Biology.
W. A. Dick-Peddie.

Desire Environments of Arid Regions of the LAND-USE PLAN FOR THE ARID

In: Future Environments of Arid Regions of the Southwest, Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Colorado Springs, Colorado, May 7-10, 1969. G. L. Bender, editor. p 9-12. 5 ref.

Descriptors: Political aspects, *Arid lands, *Southwest U. S., Social aspects, Legal aspects, *Planning, *Long term planning, *Decision making, Land classification, Ecosystems, Ecology, Biomes, *Land use, Management.

A number of features make future planning in the arid southwest difficult and hazardous. Biomass accumulation is usually exceedingly slow which accumulation is usually exceedingly slow which makes it difficult to assess recovery of secondary succession. All 'empty areas' in the United States will have great pressures placed upon them in the years ahead, and it is likely that the greatest pressures will be on the southwest arid lands. Continued overpopulation insures this and with modern technology the desert is no longer a hostile environment. A start has been made toward understanding processes and their controlling factors in arid and semiarid ecosystems through in arid and semiarid ecosystems through ecosystem analysis initiated by the grassland and ecosystem analysis intuitated by the grassiand and desert biomes studies International Biological Pro-gram. However, there is a question of whether this information will be ready in time. A stoppap plan is suggested whereby various sites could be established in all of the various major vegetation types in the southwest. Each would be committed explaining the basic functions of and factors controlling native ecosystems and from this, deter-mine the ideal potential of each site. An advantage of this plan is that it would transcend organiza-tional, economic and political boundaries. (See also W73-03118) (Black-Arizona) W73-03120

THE FUTURE HUMAN OCCUPANCE OF THE ARID SOUTHWEST, Arizona Univ., Tucson. Dept. of Geography and

Area Development. A. W. Wilson.

In: Future Environments of Arid Regions of the Southwest, Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Colorado Springs, Colorado, May 7-10, 1969. G. L. Bender, editor. p 13-22. 15 ref.

Descriptors: Political aspects, *Arid lands, *Southwest U.S., Social aspects, *Legal aspects, Planning, *Long term planning, *Decision making, Land classification, *Land use, *City planning, Community development, Management, Urbanization, Human population.

The urban explosion, which one can be reasonably sure will continue in the arid southwest, will probably see larger numbers moving in each year, as a trend, and will see them settle in new patterns. Six guidelines for when idelines for urban growth are suggested which include green belts, control of speculators, which include green betts, control of speculators, air pollution control, and visual pollution. Modernizing the structure of local government, the economic base before and after World War II, transportation and communication, and the legal approach to water use are discussed. (See also W73-03118) (Black-Arizona)

PUBLIC LAND MANAGEMENT IN THE ARB SOUTHWEST, Bureau of Land Management, Phoenix, Ariz. F. J. Weiler.

F. J. Wester.

In: Future Environments of Arid Regions of the Southwest, Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Colorado Springs, Colorado, May 7-18, 1969. G. L. Bender, editor. p 23-32.

Descriptors: Political aspects, Social aspects, *Legal aspects, *Arid lands, *Southwest U. S, *Long term planning, Planning, *Decision making, Land classification, *Land use, Managemen, Mining, Grazing, Wildlife, Litter, Soil erosion.

The history of land management problems in the U. S. and the Southwest, opposing interests in public vs. private ownership, and alternatives in disposing of public land are described. Arid public lands are defineated into desert valleys, and desert mountains—each of which are destined to play a key role in the future settlement of these areas. Problems involved with mining, grazing, wildlife, litter, off-the-road vehicle damage, and soil erosion are discussed. (See also W73-03118) (Black-Arizona) Arizona) W73-03122

ARID LANDS AND THEIR FUTURE,

Bureau of Land Management, Washin O. Lewis, Jr.

O. Lewis, Jr.
In: Future Environments of Arid Regions of the Southwest, Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Colorado Springs, Colorado, May 7-18, 1969, G. L. Bender, editor. p 33-38.

Descriptors: Political aspects, Social aspects, *Legal aspect, *Arid lands, *Southwest U. S., *Long term planning, Planning, Land classification, *Land use, Management, *Decision making.

Present and past accomplishments of the Burean of Reclamation, Geological Survey, and the Bu-reau of Indian Affairs, and their influence on fu-ture environments are discussed. Problems in-volved with Alaska's arid lands, and the threat to tundra ground cover during development of oil and mineral resources, and those related to recreational pursuits such as off-road travel in desert lands are also discussed. Emphasis on inte-governmental cooperation to develop mutually satisfactory solutions is given. (See also W73 03118) (Black-Arizona) W73-03123

PLANNING OUR URBAN ENVIRONMENT IN

THE SOUTHWEST,
Arizona State Univ., Tempe. Dept. of Political

In: Future Environments of Arid Regions of the Southwest Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Colorado Springs, Colorado, May 7-16, 1969, G. L. Bender, editor. p 41-46.

Descriptors: *Planning, *Land classification, *Land use, *City planning, Zoning, Community development, Air pollution, Water pollution, Decision making, Social aspects, Natural resources,

Eight basic industries have contributed strongly to the progress and development of the Southwest. These are: Agriculture, Construction, Natural Resources, Manufacturing, Aerospace industries, Transportation, Education, and Tourism. To supply the increasing demands for natural resources and to prevent their wanton return into the environment resulting in air, water and land pollution, the need for recovery and recycling of

natural resources damental technole the future. Proble pollution, air poll the Southwest, ale assessing public a are presented. (W73-03124

NEW TOWNS FO Colorado Univ., E M. E. Garnsey. In: Future Enviro Southwest, Cont. ociation for the mittee on Desert posium, Colorado 1969, G. L. Bende

Descriptors: *Pl ment, *City plann ing, *Decision aspects, Social as

Three hypotheses hypothesis, which lation growth of the various periods oppulated south with this new ponew cities and seemed to the various periods of the various periods 200-mile radius of hypothesis is the towns based on offers the best ho The conventions planned accretion tions of the las emphasized: (1) have become a t new towns can be will optimize the agglomeration in proval not only scientists but also spend his life in 03118) (Black-Ar W73-03125

II. S. DEEPWA VIRONMENTAL OF DEEPWATE For primary bibli W73-03136

PERSPECTIVES RESOURCE PLA North Carolina L M. M. Hufschmie Jour-2 Water Po 41, No 7, p 1353-

Descriptors: *W Conservation,
*Planning, Water
Identifiers: Goal:

Water resource p tionally have pu The concern has harness the water based problems. and national gro vationist and pre ized increasing to be develop resources over t there is need resource goals, conditions. At goals are basic

natural resources is becoming one of the most fundamental technological needs and challenges for the future. Problems involved with water use and pollution, air pollution, and land use-planning in the Southwest, along with results of a Gallup poll assessing public attitude toward the environment are presented. (See also W73-03118) (Black-M73-03124

NEW TOWNS FOR THE SOUTHWEST, Colorado Univ., Boulder.

M. E. Garnsey.

In: Future Environments of Arid Regions of the
Southwest, Contribution No. 12, American Association for the Advancement of Science Committee on Desert and Arid Zone Research Symposium, Colorado Springs, Colorado, May 7-10,
1969, G. L. Bender, editor. p 47-63, 6 tab, 3 fig, 4

Descriptors: *Planning, *Community development, *City planning, *Long term planning, *Zoning, *Decision making, Economics, Political sspects, Social aspects, Urbanization.

Three hypotheses are presented for future growth in the Southwest. The first is the 'filling-up' hypothesis, which states that the continued population growth of the U. S. has been accompanied at various periods by a 'filling-up' of the sparsely populated southwest. The second hypothesis is that this new population will be concentrated in new cities and satellite cities clustered within a 200-mile radius of the Four Corners area. The third hypothesis is that the creation of entirely new towns based on radical concepts and techniques offers the best hope for preserving the Southwest. The conventional town not only grows by unplanned accretions but also by unplanned devastations of the landscape. Two main points are emphasized: (1) diseconomies of agglomeration have become a threat to our civilization and (2) new towns can be designed in such a way that they will optimize the economies of urbanization and agglomeration in ways which will meet the approval not only of economists and other social scientists but also of the ordinary citizen who will spend his life in an urban society. (See also W73-03118) (Black-Arizona)

U. S. DEEPWATER PORT STUDY-THE EN-VIRONMENTAL AND ECOLOGICAL ASPECTS OF DEEPWATER PORTS.

For primary bibliographic entry see Field 08A. W73-03136

PERSPECTIVES AND GOALS FOR WATER RESOURCE PLANNING,

North Carolina Univ., Chapel Hill. M. M. Hufschmidt. Jour-2 Water Pollution Control Federation, Vol

Jour-2 Water Pollution Control Federation, Vol 41, No 7, p 1353-1357, July 1969. 1 ref.

Descriptors: "Water resources, "Public health, Conservation, Environment, Economics, "Planning, Water resources development. Identifiers: Goals.

Water resource planners in the United States traditionally have pursued developmental objectives. The concern has been to provide water supplies, to hames the water resource, and to alleviate waterbased problems, as required for local, regional, and national growth. Since World War II conservationist and preservation goals have been recognized increasingly, but the major thrust continues to be developmental. In planning for water resources over the next two decades and beyond, there is need to reformulate national water resource goals, and to deal effectively with new conditions. At least four fundamental national goals are basic to such reformation: economic

growth; environmental quality; public health and safety; and equity. (Bean-AWWARF) W73-03182

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

DESALTING AS A SOURCE OF WATER SUPPLY, Office of Saline Water, Washington, D.C. For primary bibliographic entry see Field 03A. W73-02861

A BUSINESSLIKE APPROACH TO FIRE PR-TOECTION CHARGES.
American Water Works Association, New York.
Committee on Financial Aspects of Fire Prevention and Protection.
For primary bibliographic entry see Field 03D.
W73-02864

IMMEDIATE COST-EFFECTIVE ABATEMENT OF WATER POLLUTION FROM NAVY SHIPS. Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02901

OIL SPILL CHARACTERISTICS AND STATISTICS, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02906

THE CONTAINMENT AND RECOVERY OF NAVY OIL SPILLS—A FINANCIAL ANALYSIS, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W71-07909

LOCATION AND EQUIPMENT FOR OIL RECOVERY TEAMS IN SAN DIEGO, Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 05G. W73-02910

POLLUTION: TAXATION OR PURIFICATION, Stockholm Univ. (Sweden). For primary bibliographic entry see Field 05D. W73-02911

PRE-IMPOUNDMENT BOATING ACTIVITY IN THE SAYLORVILLE RESERVOIR AREA, Iowa Cooperative Wildlife Research Unit, Ames. For primary bibliographic entry see Field 06B. W71-07912

CAPITAL AND OPERATING COSTS FOR CON-VENTIONAL AND ADVANCED WASTE TREATMENT.

South Tahoe Public Utility District, South Lake Tahoe, Calif. For primary bibliographic entry see Field 05D. W73-02913

EFFECT OF BRINE DISPOSAL COST ON HYPERFILTRATION PLANT OPTIMIZATION, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05E. W73-02914

COST ANALYSIS OF OPTIONAL METHODS OF SHIPBOARD WASTE DISPOSAL, Center for Naval Analysis, Arlington, Va. Systems Evaluation Group. For primary bibliographic entry see Field 05E. W73-02916 A NEW THEORY OF PRICING AND DECISION-MAKING FOR PUBLIC INVESTMENT, Florida Univ., Gainesville. Dept. of Agricultural Economics. For primary bibliographic entry see Field 06B. W73-02917

AGGREGATE RETURNS FROM WATER RESOURCE DEVELOPMENT IN GEORGIA, 1946-1965, Georgia Univ., Athens. Dept. of Agricultural Economics. For primary bibliographic entry see Field 06B. W73-02919

NET A PROFIT FROM FARM FISH CROP, For primary bibliographic entry see Field 03E. W73-02924

CATFISH PRODUCTION IN SOUTHEASTERN ARKANSAS: ESTIMATED INVESTMENT REQUIREMENTS, COSTS, AND RETURNS, FOR TWO SIZES OF FARMS, Arkansas Univ., Fayetteville. Dept. of Agricultural Economics and Rural Sociology. For primary bibliographic entry see Field 03E. W73-02926

SURVEY OF THE MERCURY REPROCESSING INDUSTRY, 1968-1970, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05G. W73-02931

COMMERCIAL SHRIMP FARMING.....NEAR-ING REALITY, Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences. For primary bibliographic entry see Field 03E. W73-02932

TAXATION AND POLLUTION-SOME COM-MENTS, Purdue Univ., Lafayette, Ind. For primary bibliographic entry see Field 05G. W73-02935

COST ALLOCATION FOR A REGIONAL POL-LUTION TREATMENT SYSTEM, For primary bibliographic entry see Field 05G. w73-02937

MODERN WATER RATES, PART II, METER WATER IN GALLONS.

The American City, Vol 87, No 9, p 146, September, 1972. I tab.

Descriptors: "Water utilization, "Water users, "Measurement. Identifiers: Gallon, Cubic foot, Water utility, Billing, Public relations.

Water utilities initially adopted the cubic foot as their billing unit of measure because the first water meters were built to measure large quantities of water. However, as the industry built smaller meters, the cubic foot was still retained as the unit of measure. For example, of a sample of 128 water utilities studied in 1954, 64.1 percent of them billed customers according to the cubic foot of water used; by 1971, of a sample of 119 utilities, 63.9 percent still used a cubic foot measure. The water industry uses the gallon as the unit of measure when calculating or reporting plant capacity, daily demand, pumpage figures, and cost of operations per unit of water produced. Consequently, since either the gallon or the cubic foot can be fitted into rate schedules, it should make no difference to the water utility which unit of measure is used. Thus,

Field 06-WATER RESOURCES PLANNING

Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

it is difficult to explain why many utilities contin It is callicult to explain why many utilities continue billing customers by the cubic foot when customers find the gallon measure much more familiar and understandable. Water utilities that are really interested in considering the customer would be well-advised to use the gallon measure. (Settle-Wisconsin) W73-479312 W73-02938

SURCHARGES AND STREAM CHARGES AS ECONOMIC INCENTIVES, North Carolina State Univ., Raleigh. Dept. of For primary bibliographic entry see Field 05G.

BENEFITS OF FLOW AUGMENTATION FOR WATER QUALITY CONTROL, Florida Univ., Gainesville. Dept. of Environmen tal Engineering.
For primary bibliographic entry see Field 05G. W73-03242

6D. Water Demand

A WATER SUPPLY-DEMAND ANALYSIS IN CLINTON COUNTY, PENNSYLVANIA: STUDY IN ECONOMIC HYDROLOGY. Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources. D. L. Raphael.

Available from the National Technical Information Service as PB-213 506, \$3.00 in paper copy, \$0.95 in microfiche. Research Project Technical Completion Report, June 1972, 50 p, 3 fig, 8 tab, 9 ref. OWRR A-009-PA (3) 14-31-0001-3238.

Descriptors: *Economic impact, *Water supply, *Water demand, Hydrology, Regional analysis, Water utilization, Water resources development, *Pennsylvania.
Identifiers: *Clinton County (Penn.).

A methodological investigation was successfully conducted with the aim of constructing a combined Water Supply-Demand and Economic Model of a region, Clinton County, Pennsylvania. The structure of the water flow and economic models are first discussed separately. The economic model is an aggregated version of an existing Leontief input-output model of Clinton County. The water flow model consists of water demand sectors corresponding to sectors of the economic model, water supply sectors cor-responding to the four major sources of water resource and a water supply-demand (transfer) sector consisting of the water utilities. These separate models are then related by means of (1) water use functions which relate water useage to economic activity and (2) water use constraints which limit economic activity in the region due to water resource scarcity. The study provided not only direct water supply-demand information for the whole region but water use and economic information concerning indirect impacts on all re-lated sectors of the combined models. Further development and use of this methodology should be fruitful. The model provides a succinct and efficient way of presenting and using a complex, inter-related set of information. W73-02610

ELECTRICAL ENERGY, DEMAND AND SUPPLY,
Joint Labs. of the Electric Utilities in the Netherlands, Arnhem. For primary bibliographic entry see Field 05C.

WATER FOR A RAPIDLY GROWING URBAN COMMUNITY—OAKLAND COUN MICHIGAN, Geological Survey, Lansing, Mich. For primary bibliographic entry see Field 03D. W73-02804 COUNTY.

WATER FOR SOUTHERN NEVADA, Montgomery (James M.) Consulting Engineers, Inc., Pasadena, Calif. Inc., Pasadena, Calif. E. L. Kostjal, F. K. Duren, and A. W. Morgner. Water and Sewage Works, Vol 119, No 5-6, Part I-II, p 106-117, 48-54, May-June 1972. 19 p, 7 fig, 4 photo, 3 tab, 8 chart, 11 ref.

Descriptors: "Water supply, "Water shortage, "Water utilization, Water resources, Water resources development, Desalination plants, Population growth, Water requirements, Interbasin transfers, Water consumption, Water reuse, Planning, Ecology, Water sources, Water costs, Aqueducts, Nevada.

Identifiers: Southern Nevada Water Project (Nevada), Las Vegas (Nevada), Las Vegas Valley (Nevada), Snake River, Lake Meade, Columbia River, Groundwater depletion.

Because of increasing population growth, present water use projections for the Las Vegas Valley in-dicate that a deficit will occur between 1993 and 2008, unless some changes are made. The water table of the area is dropping at an annual rate of 4 to 5 ft; land subsidence is more than 3 ft in some locations. Eight alternative water supply plans are considered: Four reqire pumping and transporting intrastate ground water to a reservoir near Las Vegas; a fifth uses intrastate river water and the 3 remaining plans propose acquiring out-of-state water from the Snake and Columbia Rivers or water from the Snake and Columbia Rivers or exchanging desalinized water from the Pacific Ocean for Colorado River water. The cost to consumers for water from these new sources would average \$250/acre-ft. Compared to the present cost of \$90/acre-ft. Removing ground water would adversely affect farming and the environment of Nevada. Since the per capita use of water in Las Vegas is at the very high figure of 475 gal/day, water shortages might be averted if water consumption could be reduced by substantially increasing the price of water. Several problems sumption could be reduced by substantially in-creasing the price of water. Several problems plague the proposals for reducing the threat of water shortages by dispersing the population to areas outside the Las Vegas Valley or by discouraging population increases. (USBR) W73-02848

RIVER BASIN MODELING, AN APPROACH TO COMPUTER SIMULATION OF THE BITTER-ROOT-CLARK FORK RIVER BASIN. Montana Water Resources Board, Helena. For primary bibliographic entry see Field 04A.

COMPREHENSIVE SURVEY OF ELK RIVER BASIN, VOLUME II, ECONOMIC BASE STU-

DY,
West Virginia Dept. of Natural Resources, Charleston. Div. of Water Resources.
M. N. Islam, M. S. Baloch, and E. M. Henry.
State of West Virginia, Department of Natural
Resources, Charleston, 1970. 104 p, 21 fig, 40 tab,

Descriptors: "Planning, "Forecasting, "Surveys (Data collection), "West Virginia, "River basins, Land use, Population, Employment, Water resources, Municipal water, Industrial water, Evaluation, Demand, Water demand. Identifiers: "Economic base analysis, "Elk River

The Elk River Basin, in central West Virginia, includes about 1,532 square miles and in 1960 had a population of 81,634. By the year 2020, the popula-

tion is expected to reach 116,000 and water de mand is predicted to more than double, from 1970 level of 22 mgd to a demand of 64 mgd. Mg mand is predicted to more than double, from, 1970 level of 22 mgd to a demand of 64 mgd. Monicipal sources are expected to play a greater role in meeting this demand, providing 14.1 mgd in 201 compared to 3.5 mgd in 1960. Industrial usuage with triple from 15 mgd in 1960 to 45 mgd in 2020. The following are reported: (1) basin description, (2) economic outlook, (3) agriculture, (4) forestry, (5) industry and employment, (6) population, (7) economic indicators, (8) public services, (9) water resources activities, (10) recreational resources and (11) transportation. Although rich in natural resources the basin is underdeveloped. Forestry, (8) and (11) transportation. Although rich in start resources the basin is underdeveloped. Forestry of the first predominate industry, while agriculture is on the decline. Manufacturing provides the largest percentage of employment in the area. The eductional level of the area lags behind the national level. Increased development of industry in the area would necessitate the construction of public facilities such as fire protection, schools, healt care, and water and sewage treatment plant Recreational facilities are poorly developed due highway inaccessibility and poor water quality (Poertner) W73-02860 W73-02860

THURSTON COUNTY, A COMPREHENSIVI WATER AND SEWERAGE PLAN, VOLUME E WATER PLAN. Cornell, Howland, Haves and Merryfield, Seattle

Thurston County Planning Department, Olympia Washington, March 1972. 134 p. 29 fig, 26 tab, 3

Descriptors: "Planning, "Water supply, "Sewerage, 'Regional development, Water districts, Water demand, Water Distribution (Applied), Washington, Urona areas, Rural areas, Manicipal water, Industrial water, 'Recreation demand, Puture planning (Projected), Surface waters, Groundwater, Regional analysis. Identifiers: Thurston County.

Thurston County, Washington authorized this study in an attempt to plan for future water as sewerage demands. With urban demand expected sewerage demands. With urban demand expects to rise from 10 mgd in 1990 to 28 mgd in 1990 and rural demand expected to grow to about 100,00 gpd by 1990, it is readily seen that the urban problem is much more acute than the run problem. Out of the 60 urban systems identified. 47 serve less than 50 consumers, while 6 serv between 50 and 100, and 7 systems serve more than 100 consumers. The largest system serve 23,000 people. It is recommended that regions 25,000 people: It is recommended that regions systems be developed and that the cooperation and involvement of all communities be included. Furthermore, it is recommended that all services be metered, that all utilities publish an annual rebe metered, that all utilities publish an annual r-port summarizing water use, revenue and cot data, that groundwater development programs be actively pursued, and that this plan be adopted with necessary review and revision. The regia has an adequate rainfall. It averages 53 inches se-nually in Olympia, but falls mainly in the 7 months of October through April. Cost curves are included in the appendix but, since specific plant sizes are not given project, costs cannot be sives. not given, project costs cannot be given (Poertner) W73-02865

WATER REQUIREMENTS OF SANTA BAB BARA COUNTY, 1967 TO 1990, Bookman and Edmonston, Glendale, Calif.

R. M. Edmonston. Santa Barbara County Water Agency, Santa Barbara, California, February 1968. 35 p, 9 fig, 7 tab.

Descriptors: *Planning, *Water demand, *Water supply, Forcasting, *California, Water users, Su-face waters, Groundwater, Water districts

Groundwate tion. Identifiers: * This study w

requirement tives which Water service mands were capita consu water use, i agencies. Po water usage acre-feet to sumption is feet to 86,000 uld chang ty are now i critical wate found to exist deficiency is A program for ize groundwistudied immedie implement ject water for delayed if at area, causing more State P ture unit cost W73-02868

PUBLIC EVALUATIO Missouri Uni Economics. For primary t W73-02918

MULTI-DISC QUALITY R Oregon Agric For primary b W73-02921

WATER IN G For primary b W73-02938

THE WARW OF WATER SYSTEM, Edinburgh Un Natural Resou D. C. Ledger. Institute of Br 55, p 83-110, h

Descriptors: Flow rates, water supply, (Policy), Flo resources, Da quality, Water resources plan aspects, Wate tration, Sampl Identifiers: En

One of the pro-ties in Englan whether or ne under existing Avon is used a Groundwater depletion, Municipal water, Irrigation. Identifiers: *Santa Barbara County.

This study was authorized to determine the water requirements through 1990 and to suggest alterna-tives which could be used to supply the demand. tives which could be used to supply the demand. Water service areas were set up and future demands were based on changes in population, per capita consumption, irrigation and unit changes in water use, identification of future supplies, and evaluation of water supply programs of local water agencies. Population is expected to grow from 257,000 in 1967 to 457,000 by 1990 while total states water is expected to grow from 187. water usage is expected to grow from 187,000 acre-feet to 227,000 acre-feet. Of this, urban conis expected to grow from 47,000 acre sumption is expected to grow from 47,000 acre-fect to 86,000 acre-fect. Agricultural uses of water should change very little. Some areas of the Coun-ty are now in a water-deficient condition due to overdrafts of groundwater supplies. The most critical water supply condition in the County is found to exist in the South Coastal area where the deficiency is projected to occur by 1975 or earlier. A program for additional well construction to util-ize groundwater reservoirs in this area should be unded immediately and if found feasible should ize groundwater reservoirs in this area should be studied immediately and, if found feasible, should be implemented promptly. The use of State Probe implemented promptly. In a use of State Pro-ject water for water supply to the area should be delayed if at all possible by the use of wells in the area, causing an overdraft, which would demand more State Project water and thereby reduce fu-ture unit costs. (Poertner)

PUBLIC WATER SUPPLY DISTRICTS: EVALUATION OF A NEW INSTITUTION, Missouri Univ., Columbia. Dept. of Agricultural

For primary bibliographic entry, see Field 06E. W73-02918

MULTI-DISCIPLINARY STUDY OF WATER QUALITY RELATIONSHIPS: A CASE STUDY OF YAQUINA BAY, OREGON, Oregon Agricultural Experiment Station, Corval-

For primary bibliographic entry see Field 05C. W73-02921

MODERN WATER RATES, PART II, METER WATER IN GALLIONS. For primary bibliographic entry see Field 06C. W73-02938

THE WARWICKSHIRE AVON: A CASE STUDY OF WATER DEMANDS AND WATER AVAILA-BILITY IN AN INTENSIVELY USED RIVER

re-

SYSTEM, Edinburgh Univ. (Scotland). Dept. of Forestry and Natural Resources.

Institute of British Geographers, Transactions, No 55, p 83-110, March 1972. 10 tab, 13 fig, 15 ref.

Descriptors: *Water demands, Hydrolo Flow rates, Hydrology, River flow, 'Potential water supply, 'River regulation, 'Water allocation (Policy), Flow measurement, Rivers, Water resources, Data collections, Methodology, Water quality, Water pollution, River basins, Water resources planning act, River forecasting, Social supports Water users Sevenae of Themes Administrators aspects, Water users, Sewage effluents, Adminis-tration, Sampling. Identifiers: England, Wales, *Warwickshire Avon River.

One of the problems currently facing river authorities in England and Wales is that of determining whether or not the demands being made upon rivers exceed their capacity for meeting them under existing patterns of use. The Warwickshire Avon is used as a case study to show the detailed

investigations necessary to assess accurately the balance between the demands for, and the availability of, water in an intensively used river. The demands for river water and possible sources of conflict between them are identified. The flow of the river is analyzed, particular attention is be the river is analyzed, particular attention is being given to the problems arising from defects in the available records of flow. Water demands and water availability during periods of critical low flow are compared and the balance between them is shown to require consideration of water quality. The inadequacies of the available data on water quality are discussed, and graphs are presented showing the polluted state of much of the river. Effective measures for control of pollution are showing the pointed state of much of the river. Effective measures for control of pollution are shown to require an understanding of both flow and quality characteristics throughout the river system and of the way in which these are affected by users en route. (Black-Arizona)

SYSTEMS APPROACH TO REGIONAL WATER USE AND DEMAND, Department of Fisheries and Forestry, Ottawa (Ontario). Inland Waters Branch. For primary bibliographic entry see Field 06A. W73-03238

6E. Water Law and Institutions

COLUMBIA RIVER INTERSTATE COMPACT. POLITICS OF NEGOTIATION, Washington State Water Research Center, Pull-

Available from the National Technical Informa-tion Service as PB-213 456, \$3.00 in paper copy, \$0.95 in microfiche. Washington Water Research Center, Pullman, Report No 11, August 1972, 208 p, 3 fig, 9 tab, 85 ref. OWRR A-046-WASH (1).

Descriptors: Administrative agencies, *Columbia River, *Interstate compacts, *Regional analysis, Legal aspects, Social aspects, *Interstate rivers, Water law, *Federal-state water rights conflicts.

The Columbia Interstate Compact represented an attempt to establish a regional institutional structure for river basin development as an alternative to further development by the federal government. After 18 years of negotiation, and several attempts to ratify the Compact in the state legislature, Oregon and Washington had not ratified. The other five compacting states—Idaho, Montana, Nevada, Utah, and Wyoming—all ratified the Compact. On the basis of data obtained, the following hypotheses were advanced which offer a reasonable explanation for failure of the Compact attempt. The Compact attempt became embroiled in the existing conflict regarding power generation and marketing (public vs. private) in Washington. Role perceptions of negotiators were sufficiently different from state to state and within states to different from state to state and within states to make consensus very difficult. Provisions of the Compact were adverse to vested interests of cer-tain federal agencies. In order further to substan-tiate the conclusions and to expand knowledge of the compact negotiating process, further analysis was recommended: to provide insights into the nawas recommended: to provide insignis into the na-ture of legislator preconceptions as bases for vot-ing behavior on compact ratification; to determine the extent to which the perceived role of negotia-tors, as related to the method of appointment, in-fluences their negotiating behavior; and, to exe the historical roles of states and fede agencies in water resources development in the context of compact negotiations.

WATER RESOURCES MANAGEMENT IN DELAWARE. Delaware Univ., Newark. Water Resources

For primary bibliographic entry see Field 06B.

W73-02622

INVENTORY OF ACTIVE WATER RESOURCES RESEARCH PROJECTS IN NORTH CAROLINA. North Carolina Water Resources Research Inst.

mary bibliographic entry see Field 09D. W71-02629

EPA, ENVIRONMENTAL LEGISLATION AND ENERGY,

Environmental Protection Agency, Washington,

For primary bibliographic entry see Field 05G. W73-02739

WATER AND OUR FUTURE: AN URBAN PLANNING MANUAL FOR LOCAL OFFI-CIALS, National Association of Counties Research Foun-

dation, Washington, D.C. For primary bibliographic entry see Field 06B.

W73-02872

THE IMPORPANCE OF A PRACTICAL RESEARCH INPUT TO WATER RESOURCES DEVELOPMENT, Bureau of Reclamation, Denver, Colo. For primary bibliographic entry see Field 06B.

ADJUDICATION PROVISIONS UNDER THE 1909 WATER CODE-SURVEY OF CASE LAW AND PROPOSALS FOR LEGISLATIVE LEGISLATIVE AMENDMENT,

Oregon State Univ., Eugene. School of Law. M. Eakin.

Oregon Law Review, Vol 50, p 664-711, Summer 1971. OWRR A-008-ORE (1).

Descriptors: *Water law, *Legal aspects, *Adjudication, *Water rights, Permits, Regulation, *Oregon, Water pollution control. Identifiers: *Oregon Water Code (1909).

djudication provisions of the 1909 Oregon Water Code have been a partial success in light of the problems which they were intended to solve. The special procedures provided by chapter 539 have eliminated the complex, confusing, and often overlapping private suits sometimes resulting in contradictory degrees. By placing the responsibili-ty of surveying, making maps, and reducing data to a written record on the state engineer's office, rather than on the individual claimant, the Code has reduced the possibility of inequities or error resulting from a shortage of technical know-how and private funds. This is consistent with the objectives of insuring efficiency and uniformity in pectives of insuring efficiency and unformity in this area. The recordation of water rights deter-mined according to chapter 539 procedures has facilitated both public planning and protection of individual rights. Thus many of the Code's objec-tives regarding the adjudication provisions have been met. Where the Code has failed to achieve its purposes, or has achieved them only in part, the difficulty has stemmed most often from problems which have arisen since the enactment of the Code. Problems of a legal, practical, and ecological nature have hindered the complete attainment of the Code's objectives. (Buckley-Oregon State) W73-02394

PUBLIC WATER SUPPLY DISTRICTS: EVALUATION OF A NEW INSTITUTION, Missouri Univ., Columbia. Dept. of Agricultural

M. G. Blase, W. Gottman, and C. G. McNabb. Land Economics, Vol 48, No 3, p 273-276, August,

Field 06-WATER RESOURCES PLANNING

Group 6E-Water Law and Institutions

Descriptors: "Water supply, "Institutions, "Rural areas, Water demand, Water users, Capital costs, Operating costs, Evaluation. Identifiers: "Water supply districts.

Public water supply districts are being organized in both small towns and rural areas in order to meet rural America's water requirements. These developing institutions have encountered numerous problems. While many districts have bean able to operate smoothly and with stability, numerous districts have had their existence threatened by severe fluctuations in the number of users. Many users discontinue purchasing water from the district after a few months. In fact, at the end of six months, approximately one-half of the districts surveyed in Missouri had 10 percent or more of the original users drop out. Another problem encountered by districts is hook-up failure; that is, individuals who had contracted to use water failed to hook up to the system once it was constructed. This problem confronted approximately 75 percent of the districts surveyed. These problems could perhaps be alleviated (1) through the use of penalties for those who do not honor their initial contracts, and (2) by not refunding water meter deposits when service is discontinued. Some estimates of the capital requirements and the operating and maintenance expenses involved in establishing and maintenance expenses involved in establishing and maintaning districts are provided. (Settle-Wisconsin)

TOWARDS A PHILOSOPHY OF PLANNING: AN INVESTIGATION INTO ATTITUDES HELD BY FEDERAL WATER RESOURCE PLANNERS.

Stanford Univ., Calif. Dept. of Civil Engineering. R. H. Wilson.

Engineering-Economic Planning Program Publication No EEP-42, 1970, 280 p. FWQA Program

Descriptors: *Planning, *Decision making, *Attitudes.

The study examines attitudes and perceptions of field planners in the Corps of Engineers, Bureau of Reclamation and Environmental Protection Ador Rectamation and Environmental Protection Au-ministration. Seventy personal interviews were conducted with planners chosen at random in GS-11 to 15 grades. Attitudes toward objectives, personal role, social-political structure, time and environment were examined. Understanding of agency goals was limited. Emphasis was on functions or finding means to ends, rather than on the goals sought. Environment and management objectives were rated above economic goals. Most identified with the consulting engineer's role. Planning was viewed more as a remedial response to needs than as anticipatory and goal directed. Opinion of the public's competence and motivation was low. Public involvement was sought merely to expedite plans. Congress's ultimate appropriative power was held more influential than agencies' control of alternatives and recommendations. Future images were optimistic, had short horizons and showed little anticipation of changes from existing pat-terns. Environmental attitudes were pragmatic but confused. Nature's value was both economic and intangible. Man's influence was mainly destructive; balanced policies were sought. Greater education in planning, ecology on agency laws and goals is necessary. Social awareness must in-crease. Improved public involvement should be sought; more imagination is vital. (See also W73-02956) (EPA abstract) W73-02955

AN APPROACH FOR INVOLVING LOCAL OF-FICIALS AND CITIZENS IN REGIONAL WATER QUALITY STUDIES, Stanford Univ., Calif. Dept. of Civil Engineering.

Stanford Univ., Calif. Dept. of Civil Engineering For primary bibliographic entry see Field 05G. W73-02956 POLLUTION HEARING SETS A SOUTHERN LANDMARK.

For primary bibliographic entry see Field 05G. W73-02960

ENGINEERS SCORE FEDERAL POLLUTION TACTICS.

For primary bibliographic entry see Field 05G. W73-02961

ECOLOGICAL RIVER BASIN MANAGEMENT, National Parks and Conservation Association, Washington, D.C. A. W. Smith.

National Parks and Conservation Magazine, Vol 46, No 3, p 19-22, March 1972.

Descriptors: Social aspects, Political aspects, *River basin development, *Planning, *Regulation, Evaluation, Non-structural alteratives, *Decision making, *Land management, *Legal aspects, Water resources development, Political constraints, Water policy, Aesthetics, Attitudes, Ethics, Education, Psychological aspects, Recreation, Third party effect.

The major objectives of water resources management, currently practiced by government agencies, are outmoded and destructive. Inherent problems of large dams; their over-rated benefits of irrigation, hydroelectric power, flood control, water supply, and pollution abatement are discussed. Large reservoir recreation benefits are contrasted with more 'superior' recreation such as angling, camping, picnicking, and hiking along natural streams. Comments on different types of pollution, and disadvantages of low-flow augmentation are presented. Social and political aspects of water resources management, and the importance of proper ecological planning are included. (Black-Arizona)

FUTURE ENVIRONMENTS OF ARID LANDS OF SOUTHWESTERN STATES.

OF SOUTHWESTERN STATES, Michigan Univ., Ann Arbor. Biological Station. For primary bibliographic entry see Field 06B. W73-03119

PUBLIC LAND MANAGEMENT IN THE ARID

SOUTHWEST, Bureau of Land Management, Phoenix, Ariz. For primary bibliographic entry see Field 06B. W73-03122

ARID LANDS AND THEIR FUTURE, Bureau of Land Management, Washington, D.C. For primary bibliographic entry see Field 06B. W73-03123

NEW ATTITUDES ABOUT LEGAL PROTEC-TION FOR REMAINS OF FLORIDA'S NATU-PAL ENVIRONMENT.

RAL ENVIRONMENT, Florida Univ., Gainesville. Coll. of Law. J. W. Little.

University Florida Law Review, Vol 23, No 3, p 459-513, Spring 1971. 55 p, 323 ref.

Descriptors: *Florida, *Legal aspects, *Resources management, *Planning, Resources development, Federal government, State governments, Financing, Government finance, Air pollution, Water pollution control, Pollution abatement, Pesticides, Herbicides, Administrative agencies, Administration, Legislation, Water Quality Act, Water quality, Water quality control, Waste disposal, Land use, Exploitation.

Florida is in a condition of environmental crisis, from the Cross-Florida Barge Canal to the Everglades Jetport; plans must be made and executed

to develop and protect Florida's natural resources. Problems to be considered are: (1) pollution costol, (2) waste disposal, (3) exploitation of natural resources and the land, (4) environmental anistorical preservation, (5) population control and distribution, and (6) ecological integrity and survival of the species. To meet the challeng presented by these problems, these functions must be performed: (1) comprehensive planning, (2) standard setting, (3) planning for compliance, (4) investigating for compliance, (5) enforcement, (6) ere-examination of the environmental contral system, and (7) organization of the law to react the environmental protection system. The Florida Air and Water Pollution Control Act, the Florida Pesticide Law, federal air and water pollution convented toward environmental protection. The increase and the stoppage of the Barge Canal. Regultion of land use based upon aesthetic considerations is also desirable. In all, the law must discourage protection for acts which exploit the environment for economic advantage. (Han Florida)

MISSOURI (ANALYSIS OF STATE WATE POLLUTION LAW AND COMPARISON WITE PRESENT AND PROPOSED TENNESSEE LAW, F. E. Maloney.

In: The 1971 Water Pollution Study for the State of Tennessee, Append 27, 1971. 16 p, 2 tab.

Descriptors: "Missouri, "Tennessee, "Water polution control, "Administrative agencies, Water pollution, Water quality, Water quality control, Environmental sanitation, Pollution abatemes, Water law, Legal aspects, Legislation, Administration, Administrative decisions, Water resources, Regulation, Standards, Permits, State governments.

Missouri water law is analyzed with respect to the organization of the responsible agency, jurisdiction, procedures, administrative procedures in eforcing standards, powers and duties of the administrative agent, remedies and penalties, judicial review, and special interests protected or esempted. The Missouri law is compared to that of Tennessee by use of two tables. A Water Pollutia Board operates within the Division of Health of the State Department of Public Health and Wefare. Thermal pollution and removal of properties from waters are not covered by the statute, but the act does contemplate the creation of standards of water purity. A permit system is established for operations which will discharge wastes into the state's waters. The administrative agent of the Water Pollution Board is the Executive Secretary. Violation of the statute constitutes is misdemeanor. Waters confined on the property of a single owner are exempt from the statute, which is limited to discharges of waste into waters. It is concluded that the Missouri statute is a weak an poorly organized law. (Robinson-Florida)

NORTH CAROLINA (ANALYSIS OF STATES WATER POLLUTION LAW AND COM-PARISON WITH PRESENT AND PROPOSED TENNESSEE LAW).

F. E. Maloney. In: The 1971 Water Pollution Study for the Stated Tennessee, Append 35, 1971. 16 p, 2 tab.

Descriptors: "North Carolina, "Water pollution control, "Pollution abatement, "Administration Water quality control, Standards, Permits, Water pollution, Water pollution treatment, Taxe Water pollution sources, Waste disposal, Wast treatment, Treatment facilities, Sewage disposal Legislation, Administrative agencies, Supervison

control (Power), nessee, Legal as

An analysis of control legislatio various acts. Al the Board of W empowered to a air pollution con and enforcemen the environment tion of the Boar powered to dev protection of wa prevent any poll no person may n construct new the quantity of Remedies and detailed, along w ministrative rev water pollution research. The la tives are an effect with pollution co detailed compar janich-Florida) W73-03218

TEXAS (ANALY LUTION LAW PRESENT AND F. E. Maloney. In: The 1971 Wat Tennessee, Appe

Pescriptors: *T
*Administrative
Water pollution,
lution treatment
pollution effects
tants, Superviso
Sewage disposa
facilities, Permi
Regulation, Lega

An analysis of demonstrates the statute in most w tegrated environ regulation of co Quality Board is authority in matt composition, org Board are set fo issue permits for water. Polluters joined, or forced made of the div various agencies. is a part of the de word in terms of discharge into w includes a provis of septic tanks septic tanks in a ble. A unique fea regional plannin treatment system Tennessee pollu Florida) W73-03219

6F. Nonstru

SOIL ASSOCIATION FOR III
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New Mexico A

University Park. For primary bibli W73-02623 control (Power), Air pollution, Regulation, Tenessee, Legal aspects

An analysis of North Carolina's water pollution control legislation points out the complexity of the various acts. All agency control is centralized in the Board of Water and Air Resources, which is empowered to administer a program of water and air pollution control. The Board has both planning and enforcement functions, including the setting of water quality standards and the protection of the environment. The composition and organiza-tion of the Board is described. The Board is empowered to develop water classifications for the protection of water quality and to issue permits to prevent any pollution of waters. Without a permit no person may make any new outlets into v construct new waste disposal systems, or change the quantity or quality of waste discharge. Remedies and penalties for enforcement are detailed, along with provisions for judicial and administrative review. The centralized nature of water pollution control is commended, along with the heavy emphasis on advanced planning and research. The law also recognizes that tax incentives are an effective method to induce compliance with pollution control laws. Two tables provide a detailed comparison with Tennessee law. (Smil-janich-Florida) W73-03218

TEXAS (ANALYSIS OF STATE WATER POL-LUTION LAW AND COMPARISON WITH PRESENT AND PROPOSED TENNESSEE LAW), F.E. Malone

In: The 1971 Water Pollution Study for the State of Tennessee, Append 44, 1971. 16 p, 2 tab.

Descriptors: *Texas, *Water pollution control, *Administrative agencies, *Pollution abatement, Water pollution, Water quality control, Water pollution treatment, Water pollution sources, Water pollution effects, Wastes, Waste disposal, Pollutants, Supervisory control (Power), Septic tanks, Sewage disposal, Sewage treatment, Treatment facilities, Permits, Legislation, Administration, Regulation, Legal aspects, Tennessee.

An analysis of the Texas Water Quality Act demonstrates that it is a modern water pollution statute in most ways, though it provides for no integrated environmental protection agency and no regulation of consumptive water use. The Water Quality Board is the principal state agency with authority in matters relating to water quality. The composition, organization and procedures of the Board are set forth. The Board is given power to issue permits for the discharge of wastes into water. Polluters without permits may be fined, enjoined, or forced to pay civil damages. Criticism is made of the division of pollution control among various agencies. The Act's definition of pollution is a part of the desirable current trend to define the word in terms of alteration of waters rather than discharge into waters. Unlike many state laws, it includes a provision specifically regulating the use of septic tanks and providing for prohibition of os septic tanks in a given area if the soil is not suitable. A unique feature of the law is its emphasis on regional planning in the construction of waste treatment systems. Two tables compare Texas and Tennessee pollution control law. (Smiljanich-W73-03219

6F. Nonstructural Alternatives

SOIL ASSOCIATIONS AND LAND CLASSIFI-CATION FOR IRRIGATION, LINCOLN COUN-

New Mexico Agricultural Experiment Station, University Park.

For primary bibliographic entry see Field 03F. W73-02623

A COMPUTER SIMULATION MODEL FOR FLOOD PLAIN DEVELOPMENT, PART 1: LAND USE PLANNING AND BENEFIT EVALUATION, INTASA, Menio Park, Calif. For primary bibliographic entry see Field 04A. W73-02944

A METHOD OF COMPARING FOREST PRODUCTION DATA TO AGRICULTURAL DATA IN RIVER BASIN PLANNING, Forest Service (USDA), Washington, D.C. K. A. Davidson.

ournal of Soil and Water Conservation, Vol 27, No 1, p 20-23, January-February 1972, 4 fig. 15 ref.

Descriptors: *Flood plain zoning, *Planning, Evaluation, *Non-structural alternatives, *River basin development, Project planning, Land ap-praisals, *Zoning, Land use, Methodology, Regu-lation, Alternate planning, Land management, Land classification, Decision making, Economics, Computer models, Political aspects, Management.

comparison of forest crops to farm crops in a single economic analysis is necessary in river basin planning in many areas because of rapid shifts in land use between forest and cropland Since soil capabilities in various regions range from extremely productive to highly eroded and unproductive, forestry and agriculture compete strongly for use of the better soils. A computer technique has been used to help establish an optimum distribution of land uses among the so and to evaluate resource development needs. A graphic method of determining forest production, projected yields, and production and harvesting costs for forest crops is described. The technique allows conversion of forest production data to anaual per acre values comparable to values used for farm crops. This resulted in relative budgets on 14 groups of soils referred to as soil resource groups. (Black-Arizona) W73-03093

ORGANIZATIONAL ASPECTS OF IRRIGA-

TION SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of
Sociology and Anthropology.
For primary bibliographic entry see Field 03F.
W73-03106

ORGANIZATIONAL ALTERNATIVES IN CON-SOLIDATING IRRIGATION SYSTEMS, Colorado State Univ., Fort Collins. Dept. of Sociology and Anthropology. For primary bibliographic entry see Field 03F. W73-03107

6G. Ecologic Impact of Water Development

W73-02721

GEOLOGY, SOILS, AND HYDROGEOLOGY OF VOLO BOG AND VICINITY, ILLINOIS. Illinois State Geological Survey, Urbana. For primary bibliographic entry see Field 02H. W73-02657

RADIOACTIVE WASTE REPOSITORY, LYONS, KANSAS, (FINAL ENVIRONMENTAL IMPACT STATEMENT). Atomic Energy Commission, Washington, D.C. For primary bibliographic entry see Field 05C.

ENVIRONMENTAL EFFECTS SPECIFIC TO NUCLEAR POWER PRODUCTION, Reactor Centrum Nederland, Petten. For primary bibliographic entry see Field 05C.

ENVIRONMENTAL BENEFIT-COST ANALYSIS FOR NUCLEAR POWER GENERATION, Battelle Memorial Inst. Columbus, Ohio. For primary bibliographic entry see Field 06B.

SUPERDAMS: THE PERILS OF PROGRESS. C. Sterling. Atlantic, Vol 229, No 6, p 35-41, June 1972. 3 illus.

Descriptors: "Dams, "Ecology, "Reservoirs, Fish, Aquatic weeds, Water chemistry, Insects, Earthquakes, Snails, Groundwater movement, Reservoir evaporation, Reservoir leakage, Saline soils, Reservoir silting, Water resources development, Planning, Water loss, Earth dams, Diseases, Concrete dams, Fertility, Social aspects. Identifiers: *Developing countries, High Dam Project (UAR), Pa Mong Project, Mekong River Project, Aswan Dam (UAR), Fish effects.

In past years, developing countries have often been persuaded that a dam would bring economic progress, but today some countries are questioning whether the changes brought by an immense body of water are beneficial. Dams change many things: (1) the area inundated by the reservoir; (2) chemistry of the water; (3) habitat of river and coastal fish, insects, and plants; (4) weather; (5) pressure on the crust of the earth; (6) levels and movements of underground streams and springs; movements of underground streams and springs; (7) fertility and salinity of downstream soil, conditions of the river and the coast; and (8) the people. The effects of dams in several countries are stated, but major emphasis is on the Aswan High Dam in Egypt. Problems associated with the Aswan High Dam include: (1) fish yields from Lake Nasser of 5,000 tons compared to expecta-tions of 50,000 to 100,000 tons, (2) a reservoir only half full (was to be full by 1970) resulting from evaporation and ground-water losses of more than one-third of the inflow, (3) displacement of 100,000 people from their homes, (4) infestation of the Lake Nasser shortines and irrigation canals with snails that provide homes for flukes which carry the disease, bilharzia, and (5) need for fertilyearly floods. (USBR) W73-02850

THE RELATIONSHIP BETWEEN LAND USE AND ENVIRONMENTAL PROTECTION, Argonne National Lab., Ill. Center for Environmental Studies. For primary bibliographic entry see Field 04A. W73-02915

FLOOD CONTROL AT MUSCATINE, IOWA (FINAL ENVIRONMENTAL IMPACT STATE-MENT). Army Engineer District, Rock Island, Ill. For primary bibliographic entry see Field 04A. W73-03017

ECOLOGICAL RIVER BASIN MANAGEMENT, National Parks and Conservation Association, Washington, D.C. For primary bibliographic entry see Field 06E. W73-03092

U. S. DEEPWATER PORT STUDY-THE EN-VIRONMENTAL AND ECOLOGICAL ASPECTS OF DEEPWATER PORTS. For primary bibliographic entry see Field 08A. W73-03136

FALL RIVER HARBOR, MASSACHUSETTS AND RHODE ISLAND (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT). Corps of Engineers, Waltham, Mass. New England Div. For primary bibliographic entry see Field 08A.

Field 06-WATER RESOURCES PLANNING

Group 6G—Ecologic Impact of Water Development

MILWAUKEE DIKED DISPOSAL AREA, WISCONSIN, (DRAFT ENVIRONMENTAL IMPACT STATEMENT).
Army Engineer District, Chicago, Ill.

For primary bibliographic entry see Field 05G. W73-03151

ENVIRONMENTAL PLANNING AND ECOLOG-ICAL POSSIBILITIES, Oregon State Univ., Corvallis. Dept. of Civil En-

gineering.
D. A. Bella, and W. S. Overton.
Journal of the Sanitary Engineering Division,
American Society of Civil Engineers, Vol 98, No
SA3, p 579-592, 1972. 12 ref. OWRR C-1819 (No.
3172) (1).

Descriptors: *Decision making, *Theoretical anal-ysis, *Mathematical models, *Planning, Environ-ment, Ecology, Human population, Research pri-orities, Management, Environmental effects, orities, Management Forecasting. Identifiers: Strategies.

An environmental strategy is presented that prevents conditions which would significantly destroy quality of life as perceived now and in the future; it concerns all influences of man on environment and is not limited to those influences normally included in defining pollution. In consideration of decision-making strategies, four levels can be identified, depending on scope and kind of information available. Specifically there are the certain outcome case; the uncertain outcome, probability specified, case; uncertain outcome, probability specified, case; uncertain outare the certain outcome case; the uncertain out-come, probability specified, case; uncertain out-come, probability unspecified, case; and the un-specified outcome case. The environmental strate-gy presented is based on avoidance of large scale irreversible changes. Strategy of preserved diver-sity calls for uneven distribution of man's environsity calls for uneven distribution of man's environ-mental influences to preserve environmental diversity including a wide range of untouched ecosystems. Considering the decision process and arguments presented, study of fundamental rela-tionships of the world system is absolutely required for fulfillment of management strategies dictated by the level of decisions necessary by the nature of the problem. This applied research will also address recognized problems, but will do so within the broad perspective of the entire system, and the research structure must reflect the and the research structure must reflect the knowledge that as yet unrecognized problems may be more important than those commonly recognized. (Jones-Wisconsin) W73-03184

ROUND TABLE MEETINGS ON THE DETERI-ORATION OF THE ENVIRONMENT; CON-FERENCE (IN SPANISH). Instituto Mexicano de Recursos Naturales Renovables, A.C., Mexico City.

Editions del Instituto Mexicano de Recursos Natu-

rales Removables, A. C.: Mexico City, Mexico. 1971. 258 p. Paper. Pr. \$6.00. Identifiers: Books, Conference, Deterioration, Economics, Education, *Environmental effects, Meetings, Sanitary aspects, *Symposium.

Summaries and results are presented of the round table discussions held at the Institute in Mexico City from June 21-25, 1971 on the deterioration of City from June 21-25, 1971 on the deterioration of the environment. The contents are divided into 5 sections as follows: socio-economic aspects, sani-tary aspects, industrial aspects, educational aspects and ecological aspects of environmental deterioration. Each section presents the essential aspects of its round table discussion, and a section is then presented on the discussion which fol-lowed.—Copyright 1972, Biological Abstracts, Inc. W73-03198 lowed.--Co W73-03195

NEW ATTITUDES ABOUT LEGAL PROTECTION FOR REMAINS OF FLORIDA'S NATU-RAL ENVIRONMENT, Florida Univ., Gainesville. Coll. of Law.

For primary bibliographic entry see Field 06E. W73-03216

07. RESOURCES DATA

7A. Network Design

TWO MODELS FOR HORTON'S LAW OF STREAM NUMBERS, California Univ., Irvine. Dept. of Geography. For primary bibliographic entry see Field 04A. For primar W73-03079

7B. Data Acquisition

REMOTE SENSING OF SEA ICE FROM EARTH SATELLITES, National Environmental Satellite Center, Washington, D.C. E. P. McClain.

E. F. McCain.

Proceedings available from GPO, Washington, D.C., 20402, Price \$5.25. In: International Workshop on Earth Resources Survey Systems, May 3-14, 1971, Washington, D.C.: U.S. Government Printing Office, p 581-593, 1971. 6 fig, 8 ref.

Descriptors: "Remote sensing, "Sea ice, "Aerial photography, "Satellites (Artificial), Analytical techniques, Photogrammetry, Navigation, Ships, Ice, Lakes, Rivers, Cameras, Instrumentation, Computers, Data collections, Reviews, Conferences.

Knowledge of sea ice distribution and condition particularly during periods of formation and breakup, is vital to commercial and military ship movements in the Arctic and Antarctic. The potenmovements in the Arctic and Antarctic. The potential of meteorological satellite date for mapping ice fields was quickly recognized after the first pictures from TIROS experimental satellites became available. To automatically and objectively filter clouds from scenes containing ice or snow field, a method known as minimum brightness compositing (CMB) was developed. Computer printouts of CMB brightnesses were used to obtain data samples for various areas in North American Arctic during the period mid-May through mid-September 1969. Other techniques are being developed to extend and improve sea ice surveillance from earth satellites. Infrared radiometer data from NASA's Nimbus satellites can be used to detect major ice features in the darkness of the to detect major ice features in the darkness of the polar night when television cameras or visible spectrum radiometers are useless. (Woodard-USGS) W73-02645

JET BOAT - TELLUROMETER TECHNIQUE FOR MEASURING STREAMFLOW IN LARGE

Department of the Environment, Ottawa (Ontario). Inland Waters Branch.

Technical Bulletin No 64, 1972. 19 p, 10 fig, 2 tab.

Descriptors: *Streamflow, *Discharge measure-ment, *Boats, *St. Lawrence River, *Canada, Methodology, Instrumentation, Stream gages, Ice, Hydrologic data, Flow rates, On-site tests, Technology. Identifiers: *Jet boat, *Tellurometer, Stream-gag-ing method.

A new method of measuring streamflow on large rivers is described. While this investigation deals specifically with the St. Lawrence River and dif-ficulties encountered on that river, the method can ticulties encountered on that river, the method can be related to others with similar characteristics. The metering section was at Ville La Salle, Quebec. A series of 11 discharge measurements was obtained between March 12 and June 23, 1971 employing the jet boat-tellurometer technique. The measurements were taken under varying

weather conditions through a 3.30-foot range of stage corresponding to a change in flow of 158,000 cfs. A B-56 reel was mounted on a steel boat frame across the gunwales near the stern of the boat. The Price-type meter with a 100-pound Columbus weight was used for the measurements. A crew of weight was used for the measurements. A crew of three men was needed to carry out a measurement - the boat pilot, the instrument man, and a helper. The steel-hulled jet boat performed satisfactorily through all measurements. Ice did not damage the hull, nor clog the pump impeller. Some problems were encountered with pan ice being pressel against the intake and creating a power loss. This was overcome by reversing the pump impeller and clearing the intake. The boat was operated in temperatures as low as + 10F with no mechanical problems. The boat, which held its position against the current with only momentary drifting caused by sudden surges, was never operated at greater than one-half throttle, even against currents of up to 10 feet per second. (Woodard-USGS)

A LAND-USE CLASSIFICATION SYSTEM FOR USE WITH REMOTE-SENSOR DATA, J. R. Anderson, E. E. Hardy, and J. T. Ro Geological Survey Circular 671, 1972. 16p, 18 ref.

Descriptors: *Land use, *Land classification, *Remote sensing, *Satellites (Artificial), *Unitel States, Land development, Land management, Natural resources, Water resources, Urbanazienen, tion, Forest, Agriculture, Ranges, Deserts, Tur-Identifiers: *Classification system.

The framework of a national land-use classificathe transework of a national national classifica-tion system is proposed for testing and review. The classification has been developed to meet the needs of Federal and State agencies for an up-to-date overview of land use throughout the country on a basis that is uniform in date, scale, and categorization at the more generalized first and second levels and that will be receptive to date from instrumented satellite and high-altitude air-craft platforms. The classification system utilizes the best features of existing widely used classifica-tion systems to the extent that they are amenable tion systems to the extent that they are amenable to use with remote-sensing. It is open-ended so that regional, state, and local agencies may develop more detailed land-use classification systems, at third and fourth levels, to meet their particular needs and at the same time remain compatible with each other and with the national system. The water category includes all area within the land mass of the United States that are predominantly or persistently water covered.
(Woodard-USGS)
W73-02649

MEASUREMENTS OF TURBULENCE IN WATER AT HIGH VELOCITY, Arizona Univ., Tucson. Dept. of Systems En-

gineering. For primary bibliographic entry see Field 02E. W73-02790

ON THE CORRELATION OF ELECTRICAL CONDUCTIVITY PROPERTIES OF POROUS SYSTEMS WITH VISCOUS FLOW TRANSPORT COEFFICIENTS,

Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02F.
W73-02822

THE COMING TECHNICAL REVOLUTION IN

METER READING, Philadelphia Suburban Water Co., Bryn Mawr. Pa T. V. O'Leary.

Presented at American Water Works Association Annual Conference, Denver, Colorado, June 1971.

Descriptors: *W Research and supply, Automa rocessing, Ren Measurement Identifiers: *Auto

mete developed becau meter readers an one is at home. Seveloped, increadouts and air for example, has for example, has processing center meters an hour u of 30,000. The si home and, if the p automatic meter this system began rate and reliable Readex Electroni meters through lowing a utility to day. Annual read-Installation costs the units would b matic systems ha deciding factors accuracy, althoug a major factor. (P W73-02863

METHOD FO THE THERMAL THE SURFACE, Bari Univ. (Italy). For primary biblio W73-03076

WHICH WATER BETWEEN ISC PSYCHROMETE TACT AND EXCI Hohenheim Univ Germany). Botan Man Singh Manoh Biol Plant (Praha)

Illus. Identifiers: Ci Lemon-D, Matrix D, Olive-D, Osn ntivum-D, *Ps sativum-D, *Psy Species, Thermoo M, Turgor, *Wate

Water potentials plants were measu differences in be potentials of pea (Tradescantia ver bitter lemon (Citru ropaea). With trad after the destruction negative than prevalue obtained i osmotic potential all species showed Pea leaves showed ial when cut into : tact. Application of the leaves reduced but not with trade of the water poten tetached leaves o When bitter leme watered through outside the thermo ecame consideral same leaves had plants. However, s were introduced i

Descriptors: *Water meters, *Water metering, Research and development, Reviews, Water supply, Automation, *Automatic control, Data spacessing, Remote control, Instrumentation, *Measurement. Identifiers: *Automatic meter reading.

Automatic meter reading systems are being seveloped because of the high cost of labor for meter readers and the high percentage of homes where utility meters cannot be read because no me is at home. Several such systems have been seveloped, including automatic telephone readouts and aircraft readout systems. ATandT, for example, has developed a system where a data processing center will interrogate about 300 to 450 meters an hour up to a maximum subsystem size of 30,000. The system would essentially call the some and, if the phone were not in use, shift to the untomatic meter readout circuit. Actual trials of his system began in 1967. Results have been accusated and reliable with a minimum of difficuties. Readex Electronics, Inc. has developed a system rate and reliable with a minimum of difficulties. Readex Electronics, Inc. has developed a system in which a command unit in an aircraft reads the meters through remote control units. Readout rates are estimated at 100,000 meters an hour, al-lowing a utility to read all of its meters in a single lowing a utility to read all of its meters in a single day. Annual readout cost is put at \$3.50 per meter. Installation costs will be about \$3 to 5 per unit and the units would be owned by Readex. Other automatic systems have also been developed, but the deciding factors for acceptance will be cost and accuracy, although customer acceptance could be amajor factor. (Poertner) W73-02863

A METHOD FOR THE DETERMINATION OF THE THERMAL PROPERTIES OF SOIL NEAR THE SURFACE, Bari Univ. (Italy). Istituto di Geodesin e Geofisica.

For primary bibliographic entry see Field 02G. W73-03076

WHICH WATER POTENTIAL. DIFFERENCES BETWEEN ISOPIESTIC THERMOCOUPLE BYCHROMETER MEASUREMENTS OF IN-

TACT AND EXCISED PLANT MATERIALS, Hokenheim Univ., Stuttgart-Hohenheim (West Germany). Botanisches Institut und Botanischer Garten. Man Singh Manohar.

Biol Plant (Praha). Vol 13, No 4, p 247-256. 1971.

Identifiers: Citrus-aurantium-D, nemniers: Curus-aurantum-D, Freezing, Lemon-D, Martix, Measurements, Olea-europaea-D, Olive-D, Osmotic potential, Pea-D, Pisum-ativum-D, *Psychrometers, Ross-hybrida-D, Species, Thermocouple, Tradescantia-versicolor-M, Turgor, *Water potential, *Leaves.

Water potentials of leaves from well-watered plants were measured. There were species-specific differences in both the total and the osmotic differences in both the total and the osmotic potentials of pea (Pisum sativum), tradescantia (Tradescantia versicolor), rose (Rosa hybrida), bitter lemon (Citrus aurantium) and olive (Olea europaea). With tradescantia the potential measured after the destruction of turgor by freezing was less negative than previously, which suggests that the value obtained is not identical with the real osmotic potential of the leaf. Detached leaves of all species showed less negative water potential. Pea leaves showed a less negative osmotic potential when cut into 5 pieces than when measured intel Ambiestica of vessiling to the cut water of inrea leaves showed a less negative osmotic poten-tial when cut into 5 pieces than when measured in-itet. Application of vaseline to the cut surface of the leaves reduced this effect with rose and olive, but not with tradescantia and pea. Measurements of the water potentials of comparable attached and detached leaves of tradescantia were also made. detached leaves of tradescantia were also made. When bitter lemon leaves were detached and watered through their petioles which protruded outside the thermocouple chamber, their potential became considerably less negative than when the same leaves had been attached to well-watered plants. However, similar leaves whose cut petioles were introduced into the thermocouple chamber

registered an even lower negative potential. The registered an even lower negative potential. Ine-results are consistent with the hypothesis that when a leaf is cut off a plant, or when it is cut into sections, the water previously held by matrix forces becomes available to dilute the 'spilled' cell sap and to be absorbed by adjacent cells. It thereby increased their turgor and renders the net thereby increased their turgor and renders the nex-water potential of the leaf less negative. Similarly, the apparent negative turgor of the succulent tradescantia leaves is likely to be due to dilution of the osmotic component by cell wall water. The dis-crepancies between the readings of attached and detached leaves indicate a considerable whole-plant matrix component, and the results suggest peans matrix component, and the results suggest that thermocouple psychrometer readings conducted on detached and cut-up leaves may be artifacts. Thus it is desirable to determine water potentials on leaves attached to their plants.—Copyright 1972, Biological Abstracts, Inc. W73-03096

A MOBILE LABORATORY FOR MONITORING POLLUTION ENVIRONMENTAL ITALIAN),

Istituto Superiore di Sanita, Rome (Italy). For primary bibliographic entry see Field 05A. W73-03108

REMOTE SENSING OF ENVIRONMENTAL POLLUTION, Geological Survey, Washington, D.C.

For primary bibliographic entry see Field 05A. W73-03131

REMOTE SENSING OF WATER POLLUTION, TRW systems, Redondo Beach, Calif. For primary bibliographic entry see Field 05A. W73-03132

REMOTE SENSING OF SNOW FIELDS FROM EARTH SATELLITES, National Environmental Satellite Service,

Washington, D.C. D. R. Baker.

Proceedings available from GPO, Washington, D.C. 20402 Price \$5.25. In: Proceedings International Workshop on Earth Resources Survey Systems, May 3-14, 1971, Washington, D.C., Vol 2, p 431-440, (1971). 4 fig, 2 tab, 6 ref.

Descriptors: *Remote sensing, *Hydrology *Aerial photography, *Snow surveys, Analytical techniques, Computers, Photogrammetry, Satel-lites (Artificial), Data collections, Clouds, Ice, Mountains, Lakes, Reviews, Conferences,

Two approaches to snow field delineation are used in the United States. The first of these is the viewing of individual frames or a daily mosaic of digitized data. A second approach to snow line delineation is a technique designed to automati-cally screen out most clouds. Since the satellite data can be presented digitally, they can be processed with a computer. Whereas the snow field evaluations discussed were made using 3 to 5 km resolution data, there are future satellites that will have sensors capable of 1.5 km to 100 meter resolution. In anticipation of this type of data, resolution. In anticipation of this type of data, photographs with comparable resolution and spectral bandwidths to that expected on future satellites were obtained from the S-065 experiment on Apollo 9. Considerable effort has gone into snow line delineation using available satellite data. Increasing emphasis is being put on automated extraction of such information and generation of a usable product for hydrologists. The implications are clear that the impact from future satellite and sensor systems will create an increased demand for computer processing before the data can be used by the hydrologist. (Woodard-USGS) W73-03133

NIMBUS 3 AND 4 OBSERVATIONS OF SNOW COVER AND OTHER HYDROLOGICAL FEA-TURES IN THE WESTERN HIMALAYAS. National Aeronautics and Space Administra Greenbelt, Md. Goddard Space Flight Center.

V. V. Salomonson.

Proceedings available from GPO, Washington, D. C., 20402 Price \$5.25. In: Proceedings Interna-tional Workshop on Earth Resources Survey Systems, May 3-14, 1971, Washington, D.C., Vol 2, p 443-447, (1971). 3 fig.

Descriptors: "Remote sensing, "Hydrology, 'Snow cover, "Aerial photography, "Satellites (Artificial), Mountains, Photogrammetry, Data collections, Watersheds (Basins), Runoff, Streamflow, Reviews, Conferences.
Identifiers: *Himalaya Mountains, *Indus River,

A series of photographs from the Nimbus 3 and 4 Image Dissector Camera Systems (IDCS), the Nimbus 3 High Resolution Infrared Radiometer (HRIR), and the Nimbus 4 Temperature-Humidity Infrared Radiometer (THIR) illustrate the application of the control of the con tion of data in observing snow cover and other hydrological features in the Western Himalayas. This collection of imagery shows the relative merits of daily observations of features in the visi-ble, near infrared (0.7-1.3 millimicron), and far informed (10-11 millimicron) portions of the elec-tromagnetic spectrum with sensors having nominal spatial resolutions between 4 and 8 kilometers. Particular emphasis was placed on observing fea-tures associated with the Indus River. The resolution and spectral response of the IDCS made it the best system available on Nimbus 3 and 4 for mapping the areal extent of snow cover over the mapping the areai extent or show cover over the Indus River watershed. This parameter was mea-sured in terms of the percent of the watershed covered and graphically related to the mean monthly runoff observed at a stream gaging station near the northern border of west Pakistan.
(Woodard-USGS)

HYDROLOGIC CONDITIONS VIEWED BY THE NIMBUS METEOROLOGICAL SATELLITES, Allied Research Associates, Inc., Lanham, Md.

G. A. Rabchevsky.

Proceedings available from GPO, Washington,
D.C., 20402 Price \$5.25. In: Proceedings International Workshop on Earth Resources Survey Systems, May 3-14, 1971, Washington, D.C., Vol 2, p 469-511, (1971). 19 fig, 4 tab, 50 ref.

Descriptors: *Remote sensing, *Hydrology, *Meteorology, *Aerial photography, *Satellites (Artificial), Photogrammetry, Data collections, Antarctic, Ice cover, Mississippi River, Terrain analysis, Land forming, Streamflow, Sediment transport, Vegetation, Climatology, Reviews, Conferences Identifiers: *Nimbus satellites, Niger River Valley

The unexploited value of the Nimbus meteorological sensor data relates to the satellites' ability for global, temporal, repetitive and uniform tonal and spatial coverage of the earth's surface. Examples are presented illustrating how synoptic views of large areas increase interpretive capability. The eflarge areas interpretative capacity. The effect of resolution of the Nimbus imaging systems on these observations is discussed, together with the assessment of the areal and temporal magnitude of changes observed by these systems. Two case studies are presented exemplifying the satellites' ability for repetitive observations enabling lites' ability for repetitive observations enabling monitoring under special conditions. One study deals with changes observed in the Antarctic ice conditions utilizing the Nimbus II and III television picture data. The other study deals with terrestrial changes in the Mississippi River Valley (USA) and the Niger River Valley (Africa), observed primarily in the 0.7 to 1.3 micron spectral band. The tonal variations are brought about by

Field 07—RESOURCES DATA

Group 7B-Data Acquisition

the soil moisture and vegetation boundary changes that correlate with the regional climatic and meteorological conditions. (Woodard-USGS) W73-03135

FRAUNHOFER LINE-DEPTH SENSING AP-PLIED TO WATER, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05A.

THE USE OF ELECTRICAL RESISTIVITY TO DETERMINE POROSITY OF MARINE SEDI-

Rhode Island Univ., Kingston. For primary bibliographic entry see Field 02J. W73-03141

PROJECT FOGGY CLOUD III, PHASE 1, Naval Weapons Center, China Lake, Calif. For primary bibliographic entry see Field 03B. W73-03145

7C. Evaluation, Processing and Publication

GROUNDWATER FLOW IN PARTIALLY SATURATED SOILS, Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 05B.
W73-02624

WATER RESOURCES DATA FOR COLORADO, 1971: PART 1. SURFACE-WATER RECORDS. Geological Survey, Lakewood, Colo.

Geological Survey Data Report, 1972. 409 p, 2 fig,

Descriptors: "Streamflow, "Surface waters, "Hydrologic data, "Basic data collections, "Colorado, Gaging stations, Flow rates, Average flow, Low flow, Peak discharge, Stream gages, Lakes, Reservoirs, Crest-stage gages, Storm ru-

Surface-water records are presented for the 1971 water year for Colorado, including records of streamflow or reservoir storage at gaging stations, partial-record stations, and miscellaneous sites. partial-record stations, and miscellaneous sites. Records for a few pertinent gaging stations in bor-dering States also are included. The tables of data include a description of the gaging station, and dai-ly, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs a description of the station and a monthly summary table of stage and contents are given. Data for partial-record stations intensa are given. Data for partial-record stations include measurements at low-flow partial-record stations and annual maximum stage and discharge at crest-stage stations. (Woodard-USGS) W73-02643

A LAND-USE CLASSIFICATION SYSTEM FOR USE WITH REMOTE-SENSOR DATA, For primary bibliographic entry see Field 07B. W73-02649

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE DALLAS, TEXAS METROPOLITAN

IN THE DALLAC, AREA, 1970, Geological Survey, Austin, Tex. G. R. Dempster, Jr., and B. C. Massey, Geological Survey. Data Report, 1972, 122p, 4 fig,

Descriptors: "Rainfall-runoff relationships, "Ur-ban hydrology, "Storm runoff, "Hydrologic data, "Texas, Data collections, Streamflow, Stream gages, Flow rates, Peak discharge, Rain gages, Ur-banization, Land use, Urban drainage, Hydro-graphs, Mass curves. Identifers: "Dallas (Tex).

The compilation and analysis of hydrologic data The compilation and analysis of hydrologic data collected urban or partly urban drainage basins in Dallas, Texas, metropolitan area during the 1970 water year are presented. The objectives of the program are: to determine, on the basis of historical data and hydrologic analyses, the magnitude, frequency, and areal extent of flooding; to document and define floods of greater than ordinary magnitude; and to determine the effect of urban development on flood peaks and volume. The studies involve the collection of data in seven drainage hasins within the city of Dallas and in drainage basins within the city of Dallas and in three drainage basins outside the city in Dallas County. Runoff data are based on discharge mea-County. Runoff data are based on discharge mea-surements and stage records at nine continuous-record stations and 13 crest-stage partial-record stations. Water-surface elevations are obtained at 115 flood-profile locations. Annual records of daily discharges at continuous-record gaging stations, maximum discharge at crest-stage partial-record stations and documented peak elevations at flood-profile partial-record stations are given.
(Woodard-USGS)

GEOLOGY AND GROUND WATER OF THE PAJARO VALLEY AREA, SANTA CRUZ AND MONTEREY COUNTIES, CALIFORNIA, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 04B. W73-02653

MODELING DISCHARGE AND CONSERVA-TIVE WATER QUALITY IN THE LOWER KAN-SAS RIVER BASIN,

Kansas Univ., Lawrence. Dept of Civil Engineer-For primary bibliographic entry see Field 04A. W73-02658

FLOOD PROFILES IN THE UMPQUA RIVER BASIN, OREGON, PART I, Geological Survey, Portland, Oreg.

Geological Survey, Portland, Oreg. E. A. Oster. Geological Survey Open-file Report, 1972. 119 p, 96 fig, 12 tab, 2 ref.

Descriptors: "Floods, "Flood damage, "Flood plains, "Peak discharge, "Oregon, Regional flood, Flood forecasting, Flood control, Streamflow, Historic flood, Flood profiles, Flood data, Rainfall-runoff relationships, Maps, Curves. Identifiers: "Umpqua River Basin (Oreg), Standard project flood, Intermediate regional flood.

Flooding along the Umpqua River basin in Oregon is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections and other material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights, and other technical data. The flood of December 22-23, 1964, was the highest (496.8 ft above msl) since at least 1890 on South Umpqua River near Brockway. Discharge was 105,000 cfs which is the approximate discharge for the 25-year flood. The discharge for South Umpqua River at Tiller was 60,200 cfs. Discharge at that site for the 100-year flood is 71,600 cfs. (Woodard-USGS)

SOME EXTENSIONS OF LINEAR SYSTEMS ANALYSIS IN HYDROLOGY, Purdue Univ., Lafayette, Ind. Dept. of Hydraulic

Engineering. For primary bibliographic entry see Field 02A. W73-02662

Watershed (Minn).

WATER RESOURCES OF THE MINNESOTA RIVER-HAWK CREEK WATERSI SOUTHWESTERN MINNESOTA, Geological Survey, Washington, D.C. W. A. Van Voast, W. L. Broussard, and D. E.

For sale by USGS, Washington, D C 20242 Price \$1.50 per set. Geological Survey Hydrologic is vestigations Atlas HA-391, 1972. 3 sheets, 9 ref.

Descriptors: *Water resources, *Hydrolog, *Hydrologic data, *River basins, *Minnesota Data collections, Streamflow, Flow rates, Streaa gages, Groundwater, Aquifer characteristic, Water supply, Water utilization, Water quality, Chemical analysis, Maps, Curves, Geology, Flow characteristics, Pumping, Water yield.
Identifiers: *Minnesota River-Hawk Crest Watershed (Minn)

This 3-sheet atlas describes the hydrology and water resources for the Minnesota River-Havi Creek watershed in southwestern Minnesota. The average annual precipitation is about 28 inches, if which about 25 inches returns to the atmospher through evaporation and transpiration. Average annual runoff is about 3 inches, most of which accurs during the spring and early summer months. The most accessible and widely used aquifers sebeds of sand and gravel buried in glacial deposits. The aquifers occurs over almost the entire sees as beds or sand and gravel ourned in galcial depoint. The aquifers occur over almost the entire area as furnish adequate supplies for most stock as domestic uses. Sufficient yields for municipal as irrigation purposes can generally be found by tel drilling. Most groundwater exceeds State as Federal recommended drinking water standard for iron and manganese and treatment is necessar for municipal use. Streamflow in the watershed is intermittent. Surface water is chemically suitable for most agricultural uses but may need treatment to meet municipal and industrial requirement (Woodard-USGS) W73-02663

MULTIRESERVOIR ANALYSIS TECHNIQUE IN WATER QUANTITY STUDIES, Saskatchewan-Nelson Basin Board, Regina. For primary bibliographic entry see Field 04A. W73-02664

FLOOD CONTROL STORAGE ALLOCATION BY LINEAR PROGRAMMING,

BY LINEAR PROGRAMMING, New York State Dept. of Environmental Conse-vation, Albany. Bureau of Water Resource Planning. For primary bibliographic entry see Field 04A. W73-02667

WATER RESOURCES DATA FOR GEORGIA -1971. Geological Survey, Atlanta, Ga.

Available from USGS, 900 Peachtree St., N.E. Room 301, Atlanta, Ga. Geological Survey Data Report, 1972. 259 p, 4 fig, 6 ref.

Descriptors: *Streamflow, *Flood measurement.
*Hydrologic data, *Water quality, *Georgis.
Lakes, Reservoirs, Water levels, Surface water.
Average flow, Low flow, Peak discharge, Gagin, stations, Crest-stage gages, Chemical analysis, Basic data collections.

Water resources data for the 1971 water year for Georgia include records of streamflow or reservoir Georgia include records of streamflow or reservate storage at gaging stations, partial-record station, and records of water-quality data on the chemici and physical characteristics of surface water at well as records for a few pertinent gaging as water-quality stations in bordering States. The daily table for stream-gaging stations gives the discharge corresponding to the daily mean gage

height. Peak disc rence and correstations are list Streamflow for t bove normal o outhern portion cent of record). about 10 percent the Fall Line to near the souther the monthly sum height) at the end contents during t tion is prese microbiological, (Woodard-USGS W73-02784

THE AVAILABI NEW CASTLE C Delaware Univ. Center. For primary bibli W73-02785

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RIVER BASIN M COMPUTER SIM ROOT-CLARK FO Montana Water Ro For primary biblio W73-02857

A COMPUTER I ING NUTRIENT New York State I vation, Albany, E and Development R. M. Sykes. Technical Paper N

Descriptors: *Nu Water quality co height. Peak discharges and their times of occurrence and corresponding gage heights for many stations are listed below the yearly summary. Streamflow for the 1971 water year was generally above normal over the state especially in the southern portion where flows during the last half of the year were excessive (in the highest 25 of the year were excessive (in the nignest 25 per-cent of record). Runoff for the year ranged from about 10 percent above median in areas north of the Fall Line to about 65 percent above median near the southern border. For reservoir stations, the monthly summary gives the elevation (or gage height) at the end of the month and the change in neignty at the end of the month and the change in contents during the month. Water-quality informa-tion is presented for chemical quality, microbiological, and water temperature. (Woodard-USGS) w73,0278-W73-02784

THE AVAILABILITY OF GROUND WATER IN NEW CASTLE COUNTY, DELAWARE, Delaware Univ., Newark. Water Resources Center.

For primary bibliographic entry see Field 04B. W73-02785

THE RELATIONSHIP BETWEEN THE PHYSI-CAL PROPERTIES OF UNDERWATER SEDI-MENTS THAT AFFECT BOTTOM REFLEC.

SACLANT ASW Research Centre, La Spezia

(Italy). For primary bibliographic entry see Field 02J. W73-02798

A NEW TECHNIQUE FOR ESTIMATING RECHARGE USING A DIGITAL MODEL, Geological Survey, Lakewood, Colo. Forprimary bibliographic entry see Field 04B. W73-02801

THE USE OF GAMMA LOGS IN DETERMINING THE CHARACTER OF UNCONSOLIDATED SEDIMENTS AND WELL CONSTRUCTION FEATURES,
Geological Survey, Columbus, Ohio.
For primary bibliographic entry see Field 04B.
W73-02802

PROBLEMS CONCERNING SOLUTION OF STEADY AND UNSTEADY GROUNDWATER FLOW BY STATISTICAL METHODS, Technical Univ. of Brno (Czechoslovakia). For primary bibliographic entry see Field 02G. W73-02826

THE RIVER BASIN MODEL: THE SOCIAL SCIENCE LABORATORY.
Envirometrics, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W73-02853

RIVER BASIN MODELING, AN APPROACH TO COMPUTER SIMULATION OF THE BITTER-ROOT-CLARK FORK RIVER BASIN.
Montana Water Resources Board, Helena.
For primary bibliographic entry see Field 04A. W73-02857

A COMPUTER PROGRAM FOR CALCULAT-ING NUTRIENT BALANCES.

New York State Dept. of Environmental Conservation, Albany, Environmental Quality Research and Development Unit. and Develop R. M. Sykes

Technical Paper Number 5, April 1971. 33 p, 1 tab.

Descriptors: *Nutrients, *Computer programs, *Water quality control, Water pollution control,

*New York, Water pollution sources, Lakes, Eutrophication.
Identifiers: *Nutrient balances.

A computer program was developed to compute nutrient balances to assist in the evaluation of con-trols needed for controlling nutrients in lakes. Working on the assumption that the concentration of nutrients is related to the flow and that the total load of nutrients is related to concentration and load of nutrients is related to concentration and total flow, this program will compute the daily and cumulative nutrient loads of both the streams and the lake. The relationships of the concentration and the load can all be changed in the program as long as the number of constants is not changed. Other restrictions include a maximum time period of 20 months, a maximum of 400 days and a m imum of 10 streams, both in and out of the lake. Data requirements for the program include: (1) stream name, (2) constants for computing concentrations and loads, (3) indicators for inflow versus outflow, (4) number of months of data, (5) number of days for each month, and (6) the daily flows for each day of each month. A full listing of the com-puter program is given as well as a sample problem with its output. (Poertner) W73-02838

AN EXPERIMENT IN COMPUTER-ASSISTED SUPERVISORY CONTROL OF A WATER DIS-TRIBUTION SYSTEM,

General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div. For primary bibliographic entry see Field 04A. W73-02871

RESEARCH-THE INTERFACE BETWEEN PRODUCERS AND USERS.
Nebraska Univ. TECHNOLOGY TRANSFER RESEARCH-THE INTERFACE Research Inst. For primary bibliographic entry see Field 06B. W73-02877

A NEW DATA BASE FOR SYNTAX-DIRECTED PATTERN ANALYSIS AND RECOGNITION, Connecticut Univ., Storrs. Dept. of Electrical Engineering. Y. T. Chien, and R. Ribak.

IEEE Transactions on Computers, Vol C-21, No 7, July 1972. p 790-801, 8 fig, 1 tab, 19 ref. OWRR A-042-CONN (2), 14-31-0001-3507.

Descriptors: *Computer programs, *Data storage and retrieval, Data collections. Identifiers: "Computer language, "Data base, n-dimensional grammar, Pattern analysis, Pattern recognition, Relationship matrix, Syntax, Directed

The problem of developing an appropriate data base for syntax-directed pattern analysis and recognition is considered. A new data base is introduced by generalizing the notion of concentra-tion in representing patterns with a relationship matrix. The characteristics of relationship matrix are demonstrated in the context of formal lan-guage theory. This data base will allow the removal of many present restrictions placed on the types of patterns that can be handled by syntaxdirected systems. Problems in patterns analysis (description and generation) as well as in pattern recognition are discussed and examples are given to illustrate the potential application of this data base in both of these areas. W73-02885

APPLICATION OF A DIGITAL HYDROLOGIC SIMULATION MODEL TO AN URBANIZED

Clemson Univ., S.C. Water Resources Research For primary bibliographic entry see Field 02A. W73-02946

USE OF DIGITAL COMPUTERS FOR THE HEAT AND MASS TRANSFER ANALYSES OF CONTROLLED ENVIRONMENT GREEN.

Arizona Univ., Tucson. Environmental Research For primary bibliographic entry see Field 02D. W73-03082

A METHOD OF COMPARING FOREST PRODUCTION DATA TO AGRICULTURAL DATA IN RIVER BASIN PLANNING, Forest Service (USDA), Washington, D.C. For primary bibliographic entry see Field 06F.

HYDROLOGIC RECONNAISSANCE OF BIG AND LITTLE SODA LAKES, CHURCHILL COUNTY, NEVADA, Geological Survey, Carson City, Nev.

F E Rush

Nevada Division of Water Resources, Water Resources-Information Series Report II, 1972. 1 sheet, 8 fig. 1 tab. 13 ref.

Descriptors: *Hydrologic data, *Lakes, *Nevada, *Water quality, *Water level fluctuations, Lake Descriptors: "Hydrologic data, Lakes, Nevater, Water quality, "Water level fluctuations, Lake stages, Chemical analysis, Salinity, Bathymetry, Hydrology, Data collections, Inflow, Water utilization, Irrigation, Maps, Curves.
Identifiers: "Big and Little Soda Lakes (Nev).

Several illustrations and tables of data describe the hydrology and water quality for Big and Little Soda Lakes about 7 miles northwest of Fallon, Ney, on the floor of Carson Desert. The two lakes occupy small craters composed of volcanic, basal-tic sand surrounded by a broad expanse of alluvium. On June 29, 1971, the stage of Big Soda Lake was at an altitude of 3,989.3 feet and Little Soda was at an autuse of 3,989.3 feet and Little Soda Lake, at 3,889.8 feet. The surrounding valley floor is generally at an altitude of about 4,000 feet. Dur-ing the period of stage adjustment (1906-30), the volume of Big Soda Lake increased about 20,000 acre-feet, or at an average annual rate of about 800 acre-feet. The principal dissolved constituents of Big Soda Lake, in descending order of abundance, are sodium, chloride, and sulfate. Little Soda Lake is different in that of these three dominant ions, sulfate has the highest concentration, followed by suriate has the highest concentration, followed by sodium. A continuously recording electronic fathometer was used to measure depths in the Soda Lakes in June 1971. The deepest point surveyed in Big Soda Lake was 207 feet below the lake surface. Little Soda Lake had a maximum depth of about 56 feet. (Woodard-USGS) W73-03137

BATHYMETRIC RECONNAISSANCE OF BIG AND LITTLE WASHOE LAKES, WASHOE COUNTY, NEVADA, Geological Survey, Carson City, Nev.

Nevada Division of Water Resources, Water Resources-Information Series Report 10, 1972. 1 sheet, 4 fig, 1 tab, 2 ref.

Descriptors: *Bathymetry, *Lakes, *Nevada, *Hydrologic data, *Water level fluctuations, Depth, Lake morphology, Lake morphometry, Snowmelt, Inflow, Water utilization, Irrigation, Boating, Fishing, Maps, Curves. Identifiers: *Big and Little Washoe Lakes (Nev).

The Washoe Lakes in Nevada were at a stage of 5,029.8 feet above sea level during June 1971, when the bathymetric survey was made. The lakes usually are a single body of water, because of the flooding of the intervening marshy area between Franktown Creek and the diversion ditch. Following unusually dry periods of several years, the lakes have gone dry. The last time was in 1934. A summary of stage variations for the period 1963-71 is tabulated. The maximum recorded volume for this period was 850 acre-feet on Feb. 12 and 24,

Field 07—RESOURCES DATA

Group 7C-Evaluation, Processing and Publication

1970, and the minimum was 6 acre-feet on Oct. 28, 1970, and the minimum was 6 acre-feet on Oct. 28, 1964. The principal source of water for the lake is snowmelt in the Carson range of the Sierra Nevada. Small quantities of water are imported to the Washoe Lakes from Browns, Galena, and Third Creeks west and north of the basin. Washoe Lake is used motly for fishing and boating; however, those uses are slight, probably because the lake water is highly turbid. (Woodard-USGS) W72.01138.

DEVELOPMENT OF GROUND-WATER RESOURCES IN THE ORANGE COUNTY AREA, TEXAS AND LOUISIANA, 1963-71, Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04B. W73-03139

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR COW BAYOU, BRAZOS RIVER BASIN, TEXAS, 1976, Geological Survey, Austin, Tex.

Geological Survey Data Report, 1972. 85 p, 3 fig, 3

Descriptors: *Rainfall-runoff relationships, *Small watersheds, *Streamflow, *Texas, Hydrologic data, Basic data collections, Reservoirs, Flood protection, Engineering structures, Storms, Rain gages, Stream gages, Discharge (Water), Flow rates, Water storage, Inflow, Overflow, Spillways, Hydrographs, Mass curves.
Identifiers: *Cow Bayou (Tex), *Brazos River heatin (Tex). basin (Tex).

Rainfall, runoff, and storage data collected during the 1970 water year for the 85.0-square-mile area above the stream-gaging station Cow Bayou at Mooreville, Texas are presented. The locations of floodwater-retarding structures and hydrologic in-struments in the area are shown. The 26 floodstruments in the area are shown. The 26 flood-water-retarding structures in the study area have a combined capacity of 15,510 acre-feet below flood-spillway crests and regulate floodflows from an area of 42.7 square miles, or approximately 50% of the drainage area. The weighted-mean rainfall during the 1970 water year was 32.87 inches, or 99% of the 12-year (1959-70) average of 33.35 inches for the study area. Monthly rainfall ranged from 0.11 inch in July to 6.93 inches in September. Yearly mean dischargeat the stream-gaging station was 27.1 cfs, compared with the 12-year average of 38.3 cfs. Annual runoff at the stream-gaging sta-tion was 19,640 acre-feet, or 4.33 inches. A sum-mary of rainfall-runoff data for each of 5 storms is shown. (Woodard-USGS)

ANNUAL COMPILATION AND ANALYSIS OF HYDROLOGIC DATA FOR URBAN STUDIES IN THE SAN ANTONIO,
METROPOLITAN AREA, 1970,
Geological Survey, Austin, Tex.
L. F. Land.

Geological Survey Data Report, 1972. 178 p, 1 fig, 2 tab. 3 ref.

Descriptors: *Rainfall-runoff relationships, *Ur-Descriptors: "Kaintall-runoff relationships, "Ur-ban hydrology, "Storm runoff, "Water quality, "Texas, Hydrologic data, Data collections, Streamflow, Stream gages, Flow rates, Peak discharge, Rain gages, Chemical analysis, Ur-banization, Land use, Urban drainage, Hydro-craphs, Mass.curves. graphs, Mass curves. Identifiers: *San Antonio (Tex).

A compilation and analysis of hydrologic data col-A compitation and analysis of nydrologic data con-lected in the San Antonio, Texas, urban area for the 1970 water year are presented. The objectives are: to provide data showing the effects of various stages of urbanization on flood discharge and ru-noff, considering time, variation in rainfall pat-terns, rainfall intensity, and size of the drainage

area; and to provide water-quality data showing chemical constituents, nutrients, biochemical oxygen demand, pesticides, and sediment in surfacewater runoff from floods of various magnitudes, during all seasons of the year, from areas with different types of utilization. Precipitation data are based on 21 recording rain gages in the San Antonio metropolitan area. Runoff data are based on discharge measurements and stage records at 7 stream-gaging stations, 7 crest-stage partial-record stations, one reservoir station, and water-surface elevations at 4 flood-profile partial-record stations. Water-quality data have been collected from watersheds in various stages of urban development at most of the gaging stations in the San Antonio urban area. This water-quality program provides data on the concentration of pollutants as a result of runoff from these watersheds. (Woodard-USGS) W73-03148

MAP SHOWING DRAINAGE BASINS AND HISTORIC CLOUDBURST FLOODS IN THE SALINA QUADRANGLE, UTAH, Geological Survey, Washington, D.C. R. J. Hackman, and P. L. Williams. Available from USGS, Washington, D.C. 20242, Price \$0.75. Miscellaneous Geologic Investigations Map 1-591-N, 1972. 1 sheet, 1 map, 3 ref.

Descriptors: "Floods, "Historic floods, "Cloud-bursts, "River basins, "Utah, Hydrologic data, Maps, Flood damage, Streamflow, Mudflows. Identifiens: "Salina quadrangle (Utah).

This hydrologic map, presented on one sheet ap-proximately 29 x 41 inches, shows drainage basins and historic cloudburst floods in the Salina and historic cloudburst floods in the Salina quadrangle, Utah. In the Salina quadrangle, as in most of the arid West, summer precipitation commostly occurs as thunderstorms. During these storms, rain falls as a torrentail downpour, or cloudburst, in a local area. An inch of rain or more may fall in half an hour; U.S. Weather Bureau records show that 0.4 inch of rain has fallen in a period of 5 minutes. Such a rainfall far exceeds the absorptive capacity of the ground surface, and in areas of steep, sparsely vegetated terrain the runoff forms a cloudburst flood in which loose rock, soil, and alluvium combine with water to form a soil, and alluvium combine with water to form a debris-laden mudflow. The mudflow then moves rapidly down gullies and canyons with power great enough to erode and to transport debris, and to destroy the works of man in its path. (Woodard-USGS) W73-03152

LOCATION OF WELLS AND TEST HOLES, HARTFORD NORTH QUADRANGLE, CON-

NECTICUT, Geological Survey, Washington, D.C. C. T. Hildreth, and C. H. Keune. Available from USGS, Washington, D.C. 20242. Price \$0.75. Miscellaneous Geologic Investigations Map I-784 p, 1972. 1 sheet, 1 map, 2 ref.

Descriptors: *Water wells, *Sites, *Maps, *Con-necticut, *Test wells, Locating, Mapping. Identifiers: *Hartford North quadrangle (Conn).

This map, scale 1:24,000 shows locations of water wells and test holes for Hartford North quadrangle, Connecticut. Information for wells and test holes shown on the map is on file with the U.S. Geological Survey, Hartford, Connecticut. Loga are available for most wells and all test holes. (Woodard-USGS) W73-03153

SITES OF SOLID-WASTE STORAGE AND LIQUID-WASTE DISCHARGE, HARTFORD NORTH QUADRANGLE, CONNECTICUT, Geological Survey, Washington, D.C. L. A. Weiss.

Available from USGS, Washington, D.C. 20242. Price \$0.75. Miscellaneous Geologic Investigations Map I-784 Q, 1972. 1 sheet, 1 map, 4 ref.

Descriptors: "Waste disposla, "Industrial wastes, "Municipal wastes, "Sites, "Connecticut, Maps, Solid wastes, Liquid wastes, Injection wells, Waste storage, Surface waters.

Identifiers: "Hartford North quadrangle (Conn).

This map, scale 1:24,000, of the Hartford North quadrangle, Connecticut, shows sites of industrial and municipal waste disposal. Located are sites of solid-waste storage, liquid-waste discharge to surface-water bodies (including lagoons), liquid-waste discharge into the ground, and liquid-waste discharge into the ground, and liquid-waste discharges are shown in gallons. (Woodard-USGS)
W73-03154 W73-03154

MAXIMUM CONCENTRATION OF DIS-SOLVED SOLIDS IN SURFACE WATER, HARTFORD NORTH QUADRANGLE, CON-

NetTHOUT, Geological Survey, Washington, D.C. L. A. Weiss. Available from USGS, Washington, D.C. 20242 Price \$0.75. Miscellaneous Geologic Investigation Map 1-784 O, 1972. 1 sheet, 1 map.

Descriptors: *Dissolved solids, *Surface waters, *Connecticut, *Maps, *Water quality, Sampling, Specific conductivity, Correlation analysis, Low flow, Streams, Water polymers, *Sureams, *Dissolvent Chemical analysis, Low flow, Streams, Water polymers, *Sureams, *Sur

Identifiers: *Hartford North quadrangle (Conn).

This map, scale 1:24,000, shows maximum concentrations of dissolved solids in surface water for Hartford North quadrangle, Connecticut. Dis-solved-solids content is based on field measur-ments of specific conductivity and laboratory ments of specific conductivity and laboratory analyses of water samples taken during low streamflow in 1966. During low flow, dissolved solids are at or near maximum values for the year. Water containing more than 1,000 mg/liter di-solved solids is unsuitable for many purposes. The U.S. Public Health Service recommends a limit of 500 mg/liter for drinking water. However, its use in also governed by concentrations of other con-stituents. (Woodard-USGS) W73-03155

A SELF-VERIFYING HYBRID COMPUTER MODEL OF RIVER-BASIN HYDROLOGY, Utah Water Research Lab., Logan. For primary bibliographic entry see Field 02A. W73-03183

DATA COLLECTION FOR WATER SYSTEMS

CONTROL, Arizona Univ., Tucson. C. C. Kisiel, and L. Duckstein.

In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vd 5, p 325-328, 29 August-3 September 1970. 4 p,4

Descriptors: *Data collections, *Hydrologic aspects, *Hydrologic data, Systems analysis, Decision making, Management, Risks, Bridge construction, Scour, Floods.
Identifiers: Bayesian decision theory.

For the purpose of collecting hydrologic data to understand better a particular hydrologic process and to facilitate managerial decisions, two classes of error were of primary concern: (1) system representation and (2) parameter estimation. Decision theory was taken as a potential unifying framework for error analysis of hydrologic space-time measurements, system identification, modeling and parameter hypothem wrong hypothem hydrologic hy economic interprovided anothem artisis in the control of the control o certainty in resource system shown for com-formation which Computational problem of de from annual flo encoded in the everka-Cornell W73-03241

PROBLEM-OR GUAGES IN BRIEF OVER STATE OF TH Illinois Univ., C George Bugliar In: Proceedings Association fo Research and it 5, p 329-333, 29

Descriptors: * Engineering, * jected), Econor

The evolution of reviewed, star developments i tines in a manip artificial intellig end of the 60's. practice and in nizational pro sions were mi developments in Due to increase current increas developments h were: (1) the de and (2) the de which are cheap ty (from the ap temporary IBM gates per silicon W73-03245

08. ENGIN 8A. Structu

A GLOSSARY

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W73-02654

SLOTTED CO DRAINS, California State Research Dept. E. F. Nordlin, J. Available from PB-207 933; I microfiche. Fin 636453, August,

Descriptors: *Dr pipes, *Drainage drains, Runoff, I Identifiers: *Con

ing and parameter estimation. Type I (rejecting a correct hypothesis) and Type II (accepting a wrong hypothesis) errors in testing the appropriate hydrologic hypothesis were given a formal economic interpretation. Bayesian decision theory provided another framework for considering uncertainty in prediction and control of water resource systems in a formal manner. Its use was the computing expected while of annula of the constitution of the computing expected while of annula of the constitution of the computing expected while of annula of the constitution of the computing expected while of annula of the constitution of the computing expected while of annula of the constitution of the computing expected while of annula of the constitution shown for computing expected value of sample in-formation which has value if it affects a decision. Computational results were presented for the problem of designing bridge piers against scour from annual floods whose mean and variance were encoded in the normal chi-square distribution. (Veverka-Cornell) W73-03241

PROBLEM-ORIENTED COMPUTER LANGUAGES IN HYDRAULIC ENGINEERING: A SRIEF OVERVIEW OF THEIR EVOLUTION, STATE OF THE ART AND FUTURE, Illinois Univ., Chicago. Coll. of Engineering.

George Bugliarello. George Buginareao. In: Proceedings of 14th Congress of International Association for Hydraulic Research, Hydraulic Research and its Impact on the Environment, Vol 5, p 329-333, 29 August-3 September 1970. 5 p, 10

Descriptors: *Computer programs, *Hydraulic Engineering, *Histroy, *Future planning (Projected), Economics, Optimization, Systems analy-

The evolution of problem-oriented computer lan-guages for the field of hydraulic engineering was reviewed, starting from the initial conceptual developments in the early 60's for stringing rou-lines in a maniputable system, to the systems with tines in a maniputable system, to the systems with artificial intelligence capabilities developed at the end of the 60's. The state of the art in engineering practice and in education was reviewed, the organizational problems were discussed and proviions were made as to the impact of future developments in computer hardware and software. Due to increases in computer memory and to con-current increases in speed and economy, new developments have arisen. Particularly mentioned developments have arisen. Particularly mentioned were: (1) the development of parallel processors, and (2) the development of memory elements which are cheaper and have a much greater density (from the approximately 4,000 gates of a contemporary IBM 350 computer to a possible 10,000 gates per silicon chip in 1980). (Veverka-Cornell) W73-03245

08. ENGINEERING WORKS

8A. Structures

A GLOSSARY OF COASTAL ENGINEERING

Army Enineer Div. South Pacific, San Francisco, Calif. Coastal Engineering Branch. For primary bibliographic entry see Field 08B. W73-02654

SLOTTED CORRUGATED METAL PIPE

DRAINS, California State Div. of Highways. Materials and Research Dept. E. F. Nordlin, J. R. Stoker, and B. G. Page

Available from NTIS, Springfield, Va. 22151 as PB-207 933; Price \$3.00 paper copy; \$0.95 microfiche. Final Research Report M and R 636453, August, 1971. 28 p, 16 fig, 2 tab, 1 ref, ap-

Descriptors: *Drains, *Road construction, *Metal pipes, *Drainage engineering, *California, Storm drains, Runoff, Highways, Testing. Identifiers: *Corrugated metal pipes, Wheel load-

The collection and dissipation fo surface water on The collection and dissipation fo surface water on the traveled roadway is a requirement that concerns designers and hydraulic engineers. One method of intercepting surface water without the need for any form of a surface projecting inlet structure is the slotted corrugated metal pipe drain. The ability of the alotted pipe to carry legal wheel loads in investigated. Also, the development and performance of slotted corrugated metal pipe as used on California highways are discussed. Both 14 gage and 16 gage corrugated metal pipe, 18 inches in diameter, were tested. Based upon pipe deflection data under heavy metal pipe. 18 inches in diameter, were tested. Based upon pipe deflection data under heavy wheel loads, the slotted drain pipe fabricated to standards specified in California Standard Plans, January 1971, is capable of carrying occasional legal highway wheel loads. However, a series of fatigue endurance tests should be performed on slotted pipe drains if frequent repetitive loads are anticipated. (Woodard-USGS)

DAMAGE TO KARNAFULI DAM SPILLWAY, East Pakistan Water and Power Development Authority, Dacca. For primary bibliographic entry see Field 08B.

W73-02787

EXAMPLES OF THE INTERNAL CONDITIONS

OF SOME OLD EARTH DAMS, Rofe, Kennard and Lapworth, London, (England). M. F. Kennard.

Journal of the Institution of Water Engineers, Vol 26, No 3, p 135-154, May 1972, 2 fig. 18 ref. disc.

Descriptors: *Earth dams, *Safety factors, *Dam failure, *Age, *Project life, Bibliographies, Dam construction, Boreholes, Outlet works, Spillways, Slope protection, Dam foundations, Dam design, Pore pressure, Seepage control, Underseepage, Drainage, Safety, Overtopping, Overflow, Phreatic lines, On-site investigations, Embank-Identifiers: Great Britain.

Investigation of several old dams, dating from 1794, provides a background for discussing the condition of several earth embankments in England. Of 449 British dams over 50 ft high, 91 are at least 100 yrs old, raising the question as to how many more years of useful life remain. Described are 13 older dams with results of inspections and are 15 older causes with results of inspections and borehole investigations. Even though drawings were not available for many, physical charac-teristics are described and, when known, opera-tional experiences given. Despite the 1930 Reservoir Act, inspection was considered superficial except where serious defects are obvious. Examples cited show that some old dams have existed for a long time with low factors of safety. There is no assurance that recommended remedial work will be done. Comments by several discussants are given. (USBR) W73-02841

COMPARISON OF ANALYTICAL AND STRUC-TURAL BEHAVIOR RESULTS FOR MORROW

POINT DAM, Bureau of Reclamation, Denver, Colo. M. A. Kramer, and K. Jones.
Bureau of Reclamation Report REC-ERC-72-8,
Mar 1972. 25 p, 20 fig, 1 photo, 7 tab, 16 ref.

Descriptors: *Arch dams, *Structural behavior. *Structural analysis, Concrete dams, Stress analysis, Deflection, Dam design, Instrumentation, Strain measurement, Thermal stress, Creep, Modulus of elasticity, Dam foundations, Dams, Prototupe tests, Bibliographies, Instrumentation. Identifiers: *Double-curvature arch dams, *Comparative studies, Test results, Morrow Point Dam (Colorado), Arch Dam Stress Analysis System, (Colorado), Arch Dam Stress Analysis System, Deflection measurement, Analytical method.

Effectiveness of the computerized Arch Dam Stress Analysis System (ADSAD) in the anlaysis of double-curvature arch dams and the reliability of assumptions used in the design can best be demonstrated by comparison of analytical results with deflections and stress from structural behavior measurements. Instruments indicating length change, temperature, and deflection were installed in Morrow Point Dam. Stress and deflection changes were determined for the following incremental loadings; (1) initial reservoir filling with constant temperature: (2) seasonal temperature cremental loadings; (1) initial reservoir rilling with constant temperature; (2) seasonal temperature change during the first loading cycle with constant water level; (3) change in the water level during the second loading cycle with small temperature changes; and (4) large temperature drop during the second loading cycle. Comparisons of deflection second loading cycle. Comparisons of deflection changes and stress changes are presented for each loading increment. Comparisons of the 2 incremental changes during the initial loading cycle show larger effects of inelastic foundation movements than predicted by the analyses. Comparisons of the 2 loading increments during the second loading cycle indicate foundation deformations nearer those predicted by the analytical studies. Measured and analytical results generally series (ISBN) agree. (USBR) W73-02847

GENERAL PURPOSE PROGRAM OF PLANE STRESS ANALYSIS BY FINITE ELEMENT METHOD, AND ITS APPLICATION,

Ishikawajima Heavy Industries Co. Ltd., Tokyo

(Japan). I. Neki, K. Nagai, and H. Fuke. IHI Engineering Review, Vol 5, No 1, Ser. No 8, p 10-24, Mar 1972. 13 fig, 1 tab, 7 ref.

Descriptors: *Finite element analysis, *Structural analysis, *Computer programs, Stress analysis, Elastic theory, Computers, Graphical analysis, Flow charts, Three-dimensional, Ships, Application methods

identifiers: Computer-aided design, Computer graphics, Time saving, Japan, Mesh generation, Stress distribution, Plates.

Structural analysis by finite element method has passed from the research stage to readiness for practical use. Development of a computer program large enough to handle the analysis became necessary, with size balanced by labor savings in preparing input data and in analyzing calculated results. A substructure method was employed with automatic mesh generation and periodic identical patterns. The program includes a device to check input data and adjust calculated results using block and graphic display. Identified as ZPLATE, the program deals with elastic stress of plate structures subjected to static loads, and can also handle a plate with line members treated as truss elements a pase with me members treated as truss elements because of no flexible stiffness. Two applications are discussed: (1) 3-dimensional stress analysis of a bulk (sea) carrier; and (2) longitudinal stress analysis of a destroyer. The examples exhibit from 4,000 to more than 10,000 degrees of freedom in calculation. (USBR)

W73-02852

VILLAGE TECHNOLOGY HANDBOOK. Volunteers for International Technical Assistance, Inc., Schenactady, N.Y.

Available from the National Technical Informa-tion Service as PB-207 491, \$6.00 in paper, \$0.95 in microfiche. Revised edition, May, 1970. 387 p, 255 fig, 2 tab, 1 append.

Descriptors: "Rural areas, "Technology, Water resources development, Water utilization, Irrigation, Electric power, Water purification.

Identifiers: "Economic development, "Village technology, "Crafts, "Handbooks, Villages, Less developed countries.

Field 08-ENGINEERING WORKS

Group 8A-Structures

Methods and techniques aimed at helping villagers in less developed countries master the resources available to them are presented. The techniques and devices described are those which can be made and used in the villages. Some of the practices suggested can be adopted on an individual basis; others, however, will require cooperation by many people and, perhaps, by government agen-cies. The general topics covered are water resources; health and sanitation; agriculture; food resources; hearin and sanitation; agriculture; food processing and preservation; construction; home improvement; crafts and village industry; and communications. Some of the specific topics discussed include water lifting and transport; water storage; water power; water purification; sanitary latrines; bilharziasis control; earth-moving devices for irrigation and road-building; irriga-; poultry raising; silage for dairy cows food at home; storing vegetables and fruit for winter use; how to salt fish; concrete construction; winter use; how to salf fish; concrete construction; bamboo construction, glues; solar water heaters; washing machines; cookers and stoves; home soap making; bedding; bamboo or reed writing pens; silk screening; and uses of inexpensive rubber cement. Appendices contain conversion tables for length, weight, temperature, area, volume, pressure, and power. (Settle-Wisconsin) W73-02922

FLOOD CONTROL AT MUSCATINE, IOWA (FINAL ENVIRONMENTAL IMPACT STATE-

Army Engineer District, Rock Island, Ill. For primary bibliographic entry see Field 04A. W73-03017

U. S. DEEPWATER PORT STUDY-THE EN-VIRONMENTAL AND ECOLOGICAL ASPECTS OF DEEPWATER PORTS.

Army Corps of Engineers Institute for Water Resources Report 72-8 (Vol 4 of 5 vol), August 1972. 298 p, 13 fig, 36 tab, 151 ref.

Descriptors: *Harbors, *Engineering structures, *Environmental effects, *Economic impact, *Projections, United Satates, Reviews, Evaluation, Ecology, Navigation, Dredging, Bays, Water

Identifiers: *Deepwater ports (USA), Commodity studies, Shipping.

An overall appraisal is provided of deep port needs for the United States by means of identification of the factors critical to U. S. deepwater port decision development of criteria appropriate to the son development of criteria appropriate to the evaluation of engineering, economic and environmental aspects of deep port needs and policies; analysis of the development options available, and the critical issues surrounding each; and the identification of critical issues which need further analysis. The study emphasizes port requirements for bulk commodities. This is volume 4 of 5 volumes of 'U.S. Deepwater Port Study'. Volume volumes of U.S. Deepwater Port Study. Volume II contains Commodity Studies and Projections; volume III contains Physical Coast and Port Characteristics, and Selected Deepwater Port Alternatives; and volume V contains Transport of Bulk Commodities and Benefit-Cost Relationships. (Woodard-USGS) W73-03136

FALL RIVER HARBOR, MASSACHUSETTS AND RHODE ISLAND (DRAFT ENVIRONMEN-TAL IMPACT STATEMENT). Corps of Engineers, Waltham, Mass. New En-

Available from NTIS, Springfield, Va 22151 as PB-204 659-D; Price \$3.00 paper copy; \$0.95 microfiche. October 29, 1971. 48 p, 7 tab.

Descriptors: *Channel improvement, *Dredging, *Harbors, *Massachusetts, *Rhode Island, Navigation, Ships, Transportation, Oil industry, Engineering structures, Water pollution control, Oil spills.

Identifiers: *Fall River Harbor (Mass and R. I.),
*Turning basin, *Environmental Impact State-

The Fall River Harbor project is located in Bristol County, Massachusetts and Newport County, Rhode Island. It is a navigation improvement project consisting of deepening a turning basin and dredging approximately 11 miles of channel to increase depth from 35 feet to 40 feet. Four million cubic yards of material will be dredged and deposited in a sea disposal site. Action will improve navigation conditions lessening changes for oil spills. Larger draft vessels could utilize the harbor. The first contract (summer of 1972) will probor. The first contract (summer of 1972) will provide for dredging 5.8 miles of the Mount Hope vide for dreaging 5.8 miles of the Mount Hope Bay-Fall River channel from the entrance in the bay to a point about half a mile below the Brightman Street bridge and will include all of the Tiverton channel (about 3.4 miles). The second contract, which will be initiated as soon as the old contract, which wil be initiated as soon as the old obstructive bridge is removed, will complete the project dredging and will consist of about 1.6 miles of the Fall River channel and the turning basin at the head of navigation. (Woodard-USGS) W73-03144

MILWAUKEE DIKED DISPOSAL AREA, WISCONSIN, (DRAFT ENVIRONMENTAL IMPACT STATEMENT).
Army Engineer District, Chicago, Ill.
For primary bibliographic entry see Field 05G.

W73-03151

8B. Hydraulics

TRANSPORT PROCESSES OF PARTICLES IN DILUTE SUSPENSIONS IN TURBULENT WATER FLOW - PHASE II, llinois Univ., Urbana. Water Resources Center. B. G. Jones, C. C. Meek, N. Howard, K. Salehi,

d P. R. Meka.

Available from the National Technical Informa-tion Service as PB-213 536, \$3.00 in paper copy, \$0.95 in microfiche. Illinois Water Resources Center, Urbana, Research Report No 58, 1972, 122 p, 46 fig, 7 tab, 31 ref. OWRR B-042-ILL (1). 14-31-0001-3077.

Descriptors: *Dispersion, *Turbulent flow, Water pollution sources, Flow measurements, Path of pollutants, *Particle size, Diffusion, *Suspension. Identifiers: *Turbulent particulate transport,

An increased understanding of particle motion in a turbulent fluid field has been achieved both in an analytical and in an experimental sense. Analyti-cally, a theory simplified by the restrictive con-straints of isotropy has been developed. Assump-tion of a reasonable particle energy spectrum al-lowed calculation of various statistical quantities important in the determination of the particle's turbulent motion. By such an analysis they important in the determination of the particle's turbulent motion. By such an analysis three characterizing parameters were found. Two describe inertial effects due to the particle's size and density. The crossing of the particle from one region of correlated fluid turbulence to another by virtue of its free fall velocity is described by the third. The two effects, of inertia and of free fall velocity were found to act together to determine dispersion. A well parameterized particle experi-ment was undertaken. Analysis of the particles' behavior in the turbulent flow gave a three dimen-sional characterization of their motion. In particuar calculations of velocity variances, autocorrela-tions, and energy spectra were made. These mea-surements in conjunction with measurements on the turbulent fluid field allowed comparison

between theory and experiment. (See also W7, W73-02605

DIFFUSION OF THERMALLY BUOYANT WATER JETS INTO A MOVING WATER STERAM, Rhode Island Univ., Kingston. Dept. of Mechani-cal Engineering and Applied Mechanics. For primary bibliographic entry see Field 05B. W73-02627

A GLOSSARY OF COASTAL ENGINEERING TERMS. Army Enineer Div. South Pacific, San Francisco,

Calif. Coastal Engineering Branch.

Available from NTIS, Springfield, Va. 22151, as AD-744 804; Price \$3.00 paper copy; 95 cents microfiche. Miscellaneous Paper 2-72, April 1972. 55 p, 12 fig, 5 ref.

Descriptors: Technical writing, *Coastal engineer-Descriptors: Testinical winney, Coastal eighted-ing, *Documentation, Waves (Water), Tides, Lit-toral drift, Coasta, Shore protection, Engineering structures, Coastal structures. Identifiers: *Glossaries, *Terminology.

A glossary of more than 500 terms used by coastal engineers is presented. The terms apply to such subjects as waves, tides, littoral processes, shore and coastal protection, shore structures, and coasta geomorphology. Primary sources are cited. With increased interest in coastal engineering, nev more complete and accepted understanding of esting terms is being made. The latest definition of terms used in the coastal engineering field are presented. (Woodard-USGS)

EXPERIMENTAL INVESTIGATION OF HYDRAULIC TRANSIENTS IN RIVER-RESE RVOIR SYSTEMS, PHASE III, Tennessee Univ., Knoxville. Water Resources Research Center.

Research Center.

R. L. A. de Jong, and W. A. Miller, Jr.

Available from the National Technical Information Service as PB-213 466, \$3.00 in paper copy, \$5.95 in microfiche. Tennessee Water Resources Research Center, Knoxville, Report No 22, October 1971. 45 p, 13 fig, 60 ref. OWRR B-012-TENNICAL. TENN(1).

Descriptors: "Hydraulic transients, "Rivers, *Reservoirs, "Model studies, "Surges, Waves (Water), Analytical techniques, Flumes, Design criteria, Dams, Flood control, Mathematical sudies, Equations, Hydrologic data, Correlation analysis, Open channel flow, Turbulence, Stream-flow, Flow characteristics, Channel morphology.

e-dimensional surge was studied in a laborate A one-dimensional surge was studied in a laboratory flume 1-foot wide and 65-feet long. The wave was generated by releasing water from a head tank through a mechanically-operated sluice gate. The timing of the sluice gate operation, along with the gate calibration, allowed a description of the initial ave to be formulated. The wave travel along the flume was traced in terms of maximum stage and wave front velocity (recorded by five switches along the channel). Waves were discharged into aiong the channel), waves were discharged mo dry and wet channels, using two different bottom slopes and two types of bottom roughness ele-ments (wire mesh and corrugated plate) in addition to the naturally smooth plexiglas channel. The problem of mathematically modeling surge mo-tion, including the extreme surge due to dam ruption, including the extreme surge due to dam rup-ture, is discussed. Some of the results from mathe-matical models are compared with experimental values obtained in the laboratory study. The ex-perimental results show that channel roughness and bottom slope have a significant effect upon the velocity of the advancing wave front and upon

the maximum sur (Woodard-USGS) W73-02706

OBSERVATIONS TERISTICS OF T Minnesota Univ., E. M. Sparrow, R. Journal of Fluid N 800, 1970. 4 fig, 1 p

Descriptors: *Th *Buoyancy, Densi Laboratory tests, Identifiers: *Therr

Experiments have qualitative and qui mals which ascenbove a heated he the participating technique was er field visible and f of thermals. Meas fluid temperature eneration. As se thermal has a mu nted nearly her ing rate, thermal span of the heat neration of ther validating a predic frequency of the production increa The break-up Ray hyer is shown to aties of the exp Howard's pheno kiewicz-Vanderbi W73-02757

WAVE-INDUCED STRATIFIED FLI California Univ., gineering and App R. E. Kelly. Journal of Fluid M 150, 1970. 3 fig, 15

Descriptors: *W *Boundary layers sity, Mathematics Temperature, Sur Reynolds stress, T

The boundary I waves in a fluid v are discussed in o lerian velocities For the case of steady motion is a buoyancy and dif sufficiently small are even smaller.
would appear that
sidered. Results discussed only be similar to the sur Vanderbilt) W73-02761

FOULING: TH Heat Transfer Res J. Taborek, T. Aol J. G. Knudsen. nical Enginee 59-67, February 19

Descriptors: *Fo exchangers, Heat he maximum surge height. (See also W72-02434) Woodard-USGS) W73-02706

DESERVATIONS AND OTHER CHARAC-

DESERVATIONS AND UTBER CHARAC-FERISTICS OF THERMALS, dianesota Univ., Minneapolis. 3. M. Sparrow, R. B. Husar, and R. J. Goldstein. ournal of Fluid Mechanics, Vol 41, Part 4, p 793-100, 1970. 4 fig, 1 plate, 3 ref.

Descriptors: *Thermal water, *Temperature, Buoyancy, Density, Mixing, Heated water, Heat, Laboratory tests, Hydraulics. dentifiers: *Thermals, Rayleigh Number.

Experiments have been performed to explore the qualitative and quantitative characteristics of ther-nals which ascend through the fluid environment bove a heated horizontal surface. With water as he participating fluid, an electrochemical echnique was employed which made the flow ield visible and facilitated the direct observation of thermals. Measurements were also made of the of thermals. Measurements were also made of the hind temperature above an active site of thermal eneration. As seen in flow field photographs, a hermal has a mushroom-like appearance, with a shunted nearly hemisphorical cap. At a given heating rate, thermals are generated at fixed sites which are spaced more or less regularly along the pan of the heated surface. At these sites, the eneration of thermals is neriodic in time, thereby pan of the neared surface. At these sites, the generation of thermals is periodic in time, thereby alidating a prediction of Howard. Both the spatial requency of the sites and the rate of thermal production increase with increases in heating rate. the break-up Rayleigh number of the conduction ayer is shown to be a constant (within the uncer-ainties of the experiment), which is in accord with Howard's phenomenological model. (Olesz-kiewicz-Vanderbilt)

WAVE-INDUCED BOUNDARY LAYERS IN A

TRATIFIED FLUID,
California Univ., Los Angeles. School of Engineering and Applied Science.
R. E. Kelly.
Journal of Fluid Mechanics, Vol 42, Part 1, p 139-

150, 1970. 3 fig, 15 ref.

Descriptors: *Waves (Water), *Stratification, *Boundary layers, *Thermal stratification, *Density, Mathematical models, Boundary processes,
remperature, Surface waters.
Identifiers: *Stratified fluid, Euclidentian velocity,
Parapold stratification, the stratification of the strati

Reynolds stress, Temperature distribution.

The boundary layers associated with gravity waves in a fluid with a linear variation of density are discussed in order to examine the steady Euerian velocities induces by the Reynolds stress. For the case of a standing wave, the induced steady motion is shown to decay in an outer boundary layer which perseates believed between steady motion is shown to decay in an outer boun-dary layer which represents a balance between buyancy and diffusion when the wave slope is sufficiently small but when viscous decay effects are even smaller. When the wave slope is larger, it would appear that two outer regions must be con-idered. Results for progressive waves are discussed only briefly, as they are qualitatively similar to the surface wave case. (Oleszkiewicz-Vanderbiit) Vanderbilt) W73-02761

FOULING: THE MAJOR UNRESOLVED PROBLEM IN HEAT TRANSFER, Heat Transfer Research, Inc., Alhambra, Calif.

J. Taborek, T. Aoki, R. B. Ritter, J. W. Palen, and J. G. Knudsen. Chemical Engineering Progress, Vol 68, No 2, p 39-67, February 1972. 7 fig, 29 ref.

Descriptors: *Fouling, *Heat transfer, *Heat exchangers, Heated water, Cooling, Roughness

coefficient, Sedimentation, Deposition (Sediments), Thermal water, Activation energy.
Identifiers: *Cooling water conditioning, *Fouling resistance. Gas constants.

The term fouling became established in the litera-ture to mean any undesirable deposit on heat exchanger surfaces which increases resistance to heat transfer. To be able to predict fouling-time heat transfer. 10 be able to predict roung-time behavior large data banks are necessary. How-ever, this is only one part of the problem. As a parallel objective of the fouling research program, the effects of fouling preventive measures must be considered. Proper water treatment is already a subject of considerable research by the manufac-turers of additives. Much more work remains to be done. For example, if compounds could be found which would effectively promote the formation of loose and brittle crystalline structures, the fouling growth could be much easier controlled by flow velocities. Effects of filtration in many cases have not been explored properly. Yet, suspended particles will frequently act as both fouling initiators and catalysts. Many other preventive measures will be developed; recommendations for further will be developed; recommendations for further will be developed; recommendations for further research are specified. (Oleszkiewicz-Vanderbilt) ndations for further W73-02775

EQUIVALENT ROUGHNESS FOR SHALLOW

CHANNELS, Florida Univ., Gainesville. Dept. of Coastal and

Oceanographic Engineering.
M. Krishnamurthy, and B. A. Christensen.
Journal of the Hydraulics Division, American
Society of Civil Engineers Vol 98, No HY12, p
2257-2263, December 1972. 1 fig, 2 tab, 3 ref, ap-

Descriptors: *Roughness (Hydraulic), *Open Descriptors: "Acugnness (riydraune), "Open channel flow, "Hydraulics, Equations, Mississippi River, Channel morpholgy, Discharge (Water), Open channels, Hydraulic radius, Energy gradient, Velocity.

Channel sections with different roughnesses along the wetted perimeter are often encountered in design problems, such as man-made and natural urses and in laboratory experiments. Typical design problems include partly lined canals ar tunnels with different construction materials used for the bottom and the sides. In laboratory experiments, it is a common practice when using a wide flume to disregard the effect of the sidewalls and their roughnesses on the property under investigation. It is necessary to compute the equivalent tion. It is necessary to compute the equivalent roughness coefficient for any hydraulic computation in open channels and in channels with ice cover. Taking the nonuniform shear stress distribution along the wetted perimeter into consideration, two formulas were developed for the contribution to promptes coefficient in shallow open equivalent roughness coefficient in shallow open equivalent roughness coefficient in snaiow open channel flow. The equivalent roughness coeffi-cient computed by the proposed formulas for a reach of the Lower Mississippi River is closer to the measured value of n than those computed by the existing formulas. (Knapp-USGS)

DAMAGE TO KARNAFULI DAM SPILLWAY, East Pakistan Water and Power Development Authority, Dacca. M. A. Rahman.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, Paper 9452, p 2155-2170, December 1972, 15 fig.

Descriptors: "Spillways, "Chutes, "Uplift pressure, "Dam failure, Hydraulic jump, Energy dissipation, Dam design, Hydraulics, Engineering structures, Check structures, Drops (Structures). Identifiers: "Karnafuli Dam (Bangladesh), "Spillway failure, "Chute spillways.

Damage to the spillway chute of Karnafuli Dam, Bangladesh, occurred within three months of ini-

tial operation. A model study was commissioned to aid in determining the actual cause and sequence of events leading to the failure. The model indicated that the vertical force acting on model indicated that the vertical force acting on the concrete slab at the toe of the hydraulic jump was barely sufficient to hold that portion of the slab in place at the lower discharges; this of course omitted the effect of pressure fluctuations and surges characteristic of the prototype and applied only to symmetrical operation of the spillway gates. The factor of safety proved insufficient for the prototype. What can be expected from educ-tors, under varying conditions of operation, when the underdrainage system terminates in the chute the underdrainage system terminates in the chute blocks of the stilling basin, is described. (Knapp-HSGS)

BRINK DEPTH FOR TRAPEZOIDAL BROAD-

-CRESTED WEIR, Indian Inst. of Tech., Kharagpur. Dept. of Civil

Engineering. B. N. Neogy. Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, No HY12, Paper 9427, p 2171-2189, December 1972. 12 fig, 1 tab, 14 ref, append.

Descriptors: *Weirs, *Stage-discharge relations, *Open channel flow, *Hydraulic models, Spillway crests, Discharge (Water), Hydraulics, Critical flow, Froude num Identifiers: *Broad-crested weirs.

Brink depth characteristics of broad-crested weirs include the relationship between brink depth (Yo) and critical depth for parallel flow (Ye); variation of Froude number at the brink with the ratio Yo/Yc, and variation of pressure coefficient (K). More than 400 tests performed on lucite models of broad-crested weirs of trapezoidal cross section broad-crested weirs of trapezoitati cross section with 1:1 side slope, width varying from 8.5625 ft to 20.1333 ft, slope of crest varying from level to steep, and entrances both square cornered and rounded, reveal the value of Yo/Yc ranged from 0.700 to 0.757. The value of Yo/Yc is constant for a particular weir model irrespective of discharge, but is generally different for different weir models, varying with the slope and breadth of the weir crest, and the entrance condition; the Froude number at the brink is a function of only (Yo/Yc); Number at the brink is a lunction of the brink K and thus the total residual pressure at the brink section depends on the Froude number and is, section depends on the Froude n generally, not zero. (Knapp-USGS)

SPORT, FLAT-BED FLOWS, California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resources. For primary bibliographic entry see Field 02J. W73-02789 TEMPERATURE EFFECTS IN HIGH-TRAN-

STABILITY OF FLOATING ICE BLOCKS, Iowa Univ., Iowa City. Inst. of Hydraulic For primary bibliographic entry see Field 02C. W73-02792

ROTATIONAL STABILITY IN DILUTE POLYMER SOLUTIONS, Delaware Univ., Newark. Water Resources For primary bibliographic entry see Field 02E. W73-02874

TURBULENT THERMAL DIFFUSION OF STEERM: IHEEMAL DIFFUSION OF A STEERM, Rhode Island Univ., Providence. Dept. of Mechanical Engineering and Applied Mechanics. For primary bibliographic entry see Field 05B. W73-02893

Field OB-ENGINEERING WORKS

Group BB-Hydraulics

EXPERIMENTAL INVESTIGATION OF EF-FECTS OF UNSTEADY FLOWS ON A SUB-MERGED CYLINDER, Teledyne Brown Engineering, Huntsville, Ala. D. J. Morrow, L. A. Schutzenhofer, T. G. Reed, and C. C. Shih.

and C. C. Shib.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 1-8, 1972 (release date). 5 fig, 5 ref.

Descriptors: *Unsteady flow, *Flow around objects, *Drag, *Laboratory tests, Hydraulics, Instrumentation, Pressure, Turbulence, Flow friction, Hydrodynamics.
Identifiers: *Accelerating flows.

The unsteady flow phenomena about a submerged right circular cylinder were studied in accelerating flows. A set of dimensionless parameters pertinent to unsteady flows were used to analyze pressure and force data consisting of terms of local pressure coefficients, mean lift and mean drag coefficients, instantaneous Reynolds number, and non-dimensional fluid displacement. The measured drag coefficients were found to be comparable with the calculated ones. A variation of the hydrogen bubble technique was used in obtaining drag coefficients were found to be comparable with the calculated ones. A variation of the hydrogen bubble technique was used in obtaining high speed movies of the unsteady flow phenomena about the circular cylinder. A sequence of photographs taken from these movies shows the development of the flow field around the cylinder at various times. (Knapp-USGS) W73-03019

LOSS OF PRESSURE DUE TO PERIODIC MOVEMENT OF AN OBSTACLE (SUR LA PERTE DE CHARGE DUE A UN OBSTACLE EN

MOUVEMENT PERIODIQUE), Toulouse Univ. (France). Institut de Mecanique

C. Thirriot, W. D. Longree, and H. Barthet. C. Intrinot, W.D. Longree, and H. Bartnet. In: Hydraulic research and its impact on the en-vironment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 9-16, 1972 (release date). 5 fig, 6 ref.

tors: *Unsteady flow, *Flow around objects, *Drag, *Laboratory tests, Hydraulics, In-strumentation, Pressure, Turbulence, Flow friction, Hydrodynamics.

The evolution of the coefficient of drag was studied as a function of the Reynolds' number and the oscillation of circular horizontal cylinders moved oscillation of circular horizontal cylinders moved through a tank of still water. The equipment allowed uniform and sinusoidal motion. For a constant maximum speed the parameters of oscillation could be changed. Force and motion were recorded. The results confirm the importance of the parameter a/D (amplitude of oscillation/diameter of cylinder) and show the influence of Reynolds' number between approximately 5,000 and 50,000. (Knapp-USGS)

FORCES DUE TO CYLINDERS FALLING THROUGH WATER IN A VERTICAL TUBE, Technical Univ. of Istanbul (Turkey). Div. of Hydraulic and Water Power.

K. Cecen, M. Bayazit, and A. Signier.
In: Hydraulic research and its impact on the enwironment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 17-24, 1972 (release date). 5 fig, 1 tab, 1 ref.

Descriptors: *Drag, *Settling velocity, *Flow around objects, Hydrodynamics, Laboratory tests, Hydraulics, Pipe flow.

Forces which occur during the fall of a cylinder in a vertical tube and the drag coefficient of the cylinder in such a motion were studied. Cylinders

of various diameters and specific weights were dropped in a perspex tube and forces occurring when the cylinder hit the base plate were recorded by means of an oscillograph. Using the graphs obtained by this, under the assumption that the drag coefficient is a function only of the ratio of the diameters of the falling body and of the vertical tube, a diagram can be constructed to show the variation of the drag coefficient with the height of fall. The maximum force occurring in a collision increases as an exponential function of the height of fall, but it remains constant after a limiting height of fall and differs for each size cylinder. (K-napp-USGS)

PLOW-INDUCED DYNAMIC PRESSURES ON SQUARE-SECTION CYLINDERS, Bristol Univ. (England). Dept. of Civil Engineer-

J. R. Chaplin, and T. L. Shaw

J. R. Chaplin, and T. L. Saaw.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 25-32, 1972 (release date). 5 fig, 11 ref.

Descriptors: *Flow around objects, *Drag, *Tur-bulence, *Vortices, *Pressures, Hydrodynamics, Hydrostatic pressure, Laboratory tests, Fluid mechanics, Instrumentation, Non-uniform flow, mechanics, in Unsteady flow

Measurements were made of amplitude, frequen-cy and correlation of dynamic pressures on the faces of a square section cylinder with one face faces of a square section cylinder with one face normal to flow of water, built in at both ends of its span, with an aspect ratio of 3. With low free-stream turbulence, these conditions result in minimal three-dimensional flow in the wake. The r.m.s. coefficient of fluctuating lift at the vortex shedding frequency increased from 0.90 to 1.20 with increasing Reynolds number over the range 5,150 to 13,000. At a given Reynolds number the fluctuating lift coefficient is strongly dependent 5,150 to 13,000. At a given Reynolds number the fluctuating lift coefficient is strongly dependent upon the spanwise correlation, which is determined by free-stream turbulence, leakage and end conditions, amplitude of oscillations, and aspect ratio. In given conditions, the amplitudes of dynamic pressures are related to the lateral oscillation of the formation region during vortex shedding cycles and the sensitivity of the velocity at the separation points to lateral movements of the shear layers. (Knapp-USGS) W73-03022

DRAG COEFFICIENT AND TURBULENCE CHARACTERISTICS, Lehigh Univ., Bethlehem, Pa. Dept. of Civil En-

S. C. Ko, and W. H. Graf.

S. C. Ko, and w. H. Graft. In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 33-39, 1972 (Release date). 2 fig, 7 ref.

Descriptors: "Flow around objects, "Drag, "Tur-bulence, "Vortices, "Pressures, Hydrodynamics, Hydrostatic pressure, Laboratory tests, Fluid mechanics, Instrumentation, Non-uniform flow,

A functional correlation between the drag coeffi-cient of circular cylinders and turbulence charac-teristics is based on experimental studies con-ducted in an air duct and supplemented with some data obtained in a water tunnel. The experiments data obtained in a water tunnel. The experiments were performed over a range of Reynolds numbers based on mean velocity and cylinder diameter between 1,350 and 40,000. A constant temperature turbulence intensity, which was between 1,2% and 21%. The range of a dimensionless turbulence scale was 0.5 to 3.3. Two smooth circular cylinders were used. They were 1/4- and 1/2-inch in diameter. (Knapp-USGS) W73-03023

WAKE DYNAMICS OF TWO-DIMENSIONAL STRUCTURES IN CONFINED FLOWS, Bristol Univ. (England). Dept. of Civil Engineer-

ing.
T. L. Shaw.
In: Hydraulic research and its impact on the eavironment; Proceedings of 14th Congress of Intenational Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 41-48, 1972 (release date). 8 fig. 12 ref.

Descriptors: °Flow around objects, °Drag, °Tur-bulence, °Vortices, °Pressures, Hydrodynamics, Hydrostatic pressure, Laboratory tests, Fluid mechanics, Instrumentation, Non-uniform flow, Unsteady flow.

Unsteady flow.

The frequency of vortex motion behind flat plates and circular and square cylinders was studied in the restricted flow of a channel. The cylinders were moved through still water, and the patterns in the wake were shown up by lycopodium powder spread on the water surface. A relationship was established between frequency and the restriction caused by the cylinder in the channel. The Stronhal number for circles, plates, and squares is creases with blockage ratio (defined as the ratio body width to flume width). A marked increase in frequency for wider bodies is evident, the rate increasing more quietly for higher blockage ratios. Flow beneath a sluice gate and over a wall projecting from a straight boundary geometrically resemble one half of the flow past a normal flat plate in a channel. The form of vortex shedding in these two situations was compared by a series of test, progressively displacing normal flat plates of various widths from the center of the flume until one. ous widths from the center of the flume until one edge came close to the wall of the flume. This is analogous to the lowering edge of stoplogs. The effect of restricting the movement of one shear layer is to increase shedding frequency. (Knapp-USGS) W73-03024

THE FREQUENCY OF OSCILLATING FORCES ACTING ON BLUFF CYLINDERS IN CONSTRICTED PASSAGES,

Purdue Univ., Lafayette, Ind. School of Civil Engineering. G. H. Toebes.

In: Hydraulic research and its impact on the enin: riyuraunc research and its impact on the en-vironment; Proceedings of 14th Congress of Inte-national Association for Hydraulic Research, Paris, August 29-September 3, 1971. Volume 2, p 49-58, 1972 (release date). 8 fig. 1 tab, 11 ref.

Descriptors: *Flow around objects, *Drag, *Turbulence, *Vortices, *Pressures, Hydrodynamics, Hydrostatic pressure, Laboratory tests, Fluid mechanics, Instrumentation, Non-uniform flow,

Laboratory investigations on bluff body wakes and the fluid elastic forces acting on test cylinders are generally made without regard to blockage effects. In many instances, however, the experimen-tal flow field is constricted. Data on how blockage affects the Strouhal frequency and the oscillatory arrects the Strounal frequency and the oscillatory lift for structural shapes as a result of test wall interaction with the wake flow are needed in planning laboratory tests as well as interpreting data resulting therefrom. Approaches to the problem, original lift and drag data for equilateral triangular cylinders, and data for lift and Strouhal forms and the problem of the prob triangular cylinders, and data for lift and Strouhal frequency dependence on blockage for a circular and a triangular cylinder are described. Preliminary results are reported for the effect of blocking on fluid elastic forces. Lift and Strouhal frequency for a circular cylinder increase with blockage in the range tested. The effect of increased blocking is to displace the reverse flow region in the downstream direction. This probably means that the vortices form pressures do not edge but in downstream. Inc minimum p der. (Knapp-

AMPLITUDE-DE AN OSCILLATI -VELOCITY FLO Technische Uni

P. G. Franke, and In: Hydraulic re-vironment; Proce tional Associa Paris, August 29-59-66, 1972 (relea

Descriptors: *Flobulence, *Vortice Hydrostatic pre mechanics, Instru Unsteady flow.

Experimental involute cular cylinder are lent natura litudes of v road velocity frequencies were film probe. Thes with the cylinder coincide with the fixed end of the c W73-03026

EXTENSION OF UNSTEADY II FLOWS, lowa Inst. of Hye E.O. Macagno, a In: Hydraulic re vironment; Proce Paris, August 29 67-74, 1972 (relea

Descriptors: *Fl around objects Hydrodynamics, tices, Analytical Pipe flow.

Calculation of f flows is usually bility of using a desirable. How t to determine ackinetic energy conet is also shown irrotational flows of constructing to an approximate dimensional flow W73-03027

ACCELERATE OSCILLATING Indian Inst. of T Engineering. N. S. V. Kamesw In: Hydraulic re vironment; Processional Associ Paris, August 29 75-82, 1972 (release

Descriptors: *Fl bulence, *Vortic Hydrostatic pre mechanics, Inst Unsteady flow.

the vortices form further downstream. The lowest pressures do not occur along the cylinder's trailing odge but in the vortex formation region downstream. Increased blockage seems to shift the minimum pressure region closer to the cylinder. (Knapp-USGS) w73-03025

AMPLITUDE-DEPENDENT FREQUENCY OF AN OSCILLATING CYLINDER IN A HIGH--VELOCITY FLOW, Technische Universitaet, Munich (West Ger-

P. G. Franke, and F. Valentin.

P. G. Franke, and F. Valentin. In: Hydraulic research and its impact on the en-vironment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 39-66, 1972 (release date). 4 fig, 5 ref.

Descriptors: *Flow around objects, *Drag, *Tur-bulence, *Vortices, *Pressures, Hydrodynamics, Hydrostatic pressure, Laboratory tests, Fluid mechanics, Instrumentation, Non-uniform flow, Unsteady flow.

Experimental investigations on an oscillating cir-cular cylinder are described. Due to an amplitude-dependent natural frequency of the cylinder, large amplitudes of vibration were measured over a amplitudes of vibration were measured over a broad velocity range. The vortex-shedding frequencies were determined by means of a hot-film probe. These frequencies are nearly identical with the cylinder frequencies at the free end and coincide with the Stroubal frequencies beneath the fixed end of the cylinder. (Knapp-USGS) W73-03026

EXTENSION OF THE FLOW-NET METHOD TO UNSTEADY INTERNAL AND EXTERNAL

TOWS, Iowa Inst. of Hydraulic Research, Iowa City. B. O. Macagno, and M. Macagno. In: Hydraulic research and its impact on the enin: Hydraunc research and its impact on the en-vironment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 67-74, 1972 (release date). 4 fig, 11 ref.

Descriptors: *Flow nets, *Unsteady flow, *Flow around objects, Non-uniform flow, Drag, Hydrodynamics, Hydraulics, Turbulence, Vortices, Analytical techniques, Closed conduit flow, Fipe flow.

Calculation of forces and moments in unsteady Calculation of forces and moments in unsteady flows is usually difficult. For such cases, a possi-bility of using a flow-net approach can be used desirable. How the flow-net approach can be used to determine added masses (or the equivalent kinetic energy coefficients) is described. The flow net is also shown to be useful for a certain class of irrotational flows in which the velocity potential is a separable function of time and space. A method of constructing the flow net is presented, based on an approximate geometrical property of two-dimensional flow nets. (Knapp-USGS) W73-03027

ACCELERATED MOTION OF A SPHERE IN AN OSCILLATING FLUID, Indian Inst. of Tech. Kanpur, U.P., Dept. of Civil

Indian Inst. of Tech. Kanpur, U.F., Dept. of Ciri-Engineering. N. S. V. Kameswara Rao, and S. P. Dasgupta. In: Hydraulic research and its impact on the en-vironment; Proceedings of 14th Congress on Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 75-82, 1972 (release date). 5 fig. 8 ref.

Descriptors: *Flow around objects, *Drag, *Tur-bulence, *Vortices, *Pressures, Hydrodynamics, Hydrostatic pressure, Laboratory tests, Fluid mechanics, Instrumentation, Non-uniform flow, Unsteady flow.

Identifiers: *Accelerating flow.

Starting from Basset's equation of the accelerated motion of a sphere in a stationary viscous fluid, the accelerated motion of a sphere in an oscillating fluid was analyzed, assuming a single degree of freedom. The resulting equation of motion was solved using a numerical integration technique. The solutions are presented graphically and are compared with experimental results. (Knapp-USGS) W73-03028

MOMENT CHARACTERISTICS OF CASCADES UNDER NONSTATIONARY FLOW CONDI-

Moskovskii Inzhenerno-Stroitelavi Institut

G. I. Krivchenko, L. A. Zolotov, and V. M.

Ristorov.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 83-91, 1972 (release date), 4 fig. 3 ref.

Descriptors: *Unsteady flow, *Non-uniform flow, *Flow around objects, *Turbines, *Penstocks, Pipe flow, Closed conduit flow, Hydraulics, Hydrodynamics, Turbulence. entifiers: *Accelerating flow, *Cascades (Pipe

Experimental and theoretical investigations were made of hydrodynamic characteristics of cascades with various objects in the nonstationary flow. Prototype tests were made with cascades in two types of hydraulic turbine runners. The disturbances of the tested constant speed cascades were supplied by guide vanes either in the form of periodic (harmonic) changes of the input circula-tion or as a transient phenomenon. The principal effects of nonstationary regime are caused by vertical mass and the change of the moment frequency response resulting from the guide vane opening. The virtual mass can be taken into account by the appropriate increase of inertia constant. (Knapp-USGS)

CALCULATION GENERALIZED HYDRODYNAMIC FORCES FOR KAPLAN TURBINE BLADES OSCILLATING IN THE LIQUID FLOW, Institut Gidrodinamiki, Novosibirsk (USSR).

D. N. Gorelov.

In: Hydraulic research and its impact on the en-vironment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 93-100, 1972 (release date). 5 fig, 2 ref.

Descriptors: *Unsteady flow, *Non-uniform flow, Flow around objects, *Turbines, *Penstocks, Pipe flow, Closed conduit flow, Hydraulics, Hydrodynamics, Turbulence.

A theoretical investigation was made of unsteady hydrodynamic forces acting on hydroturbine blades. In some cases generalized hydrodynamic forces can be calculated approximately in terms of two-dimensional unsteady wing and cascade theories. The hydrodynamic interference of adjacent blades decreases when the Strouchal number becomes greater. At small values of Strouchal number the distribution of hydrodynamic pressure is practically unchanged along the blade span. (K-napp-USGS) W73-03030

FORCES ON A SUBMERGED BREAKWATER, Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 101-108, 1972 (release date). 8 fig. 3 ref.

Descriptors: *Breakwaters, *Waves (Water), *Loads (Forces), Coastal engineering, Coastal structures, Peak loads, Pressure, Model studies, Effective stress. Identifiers: *Wave force

The horizontal and vertical forces caused by waves passing over submerged breakwater were measured in a series of model tests. A simplified theory was employed to calculate forces and over-turning moments. Theoretical forces and overturning moments were compared. A linear relationship was found for the horizontal forces and the overturning moment, and the calculated were always greater than the measured forces. Measured vertical forces were not a linear function of the calculated forces and in addition the measured forces were greater. The experiments provide an empirical method for computing forces on rectangular submerged structures. Measured values of the reflection coefficient are also given, as it is a necessary quantity to undertake the simple calcu-lation. (Knapp-USGS) W73-03031

HYDRODYNAMIC FORCES ON DIFFUSER PIPES DUE TO BARGE PASSAGE.

Tennessee Valley Authority, Norris. Engineering

S-T. Hsu, E. E. Driver, and R. A. Elder. In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 109-116, 1972 (release date). 8 fig, 4 ref.

Descriptors: *Hydrodynamics, *Outlets, *Drag, *Hydrostatic pressure, *Barges, Canals, Hydraulics, Open channels, Navigation.
Identifiers: *Diffuser pipes.

Laboratory experiments were conducted to determine hydrodynamic forces acting on a single diffuser pipe due to flow velocity and barge passage. A dimensional analysis of the problem indicated that the lift and drag coefficients depend upon twelve dimensionless parameters representing barge velocity, barge geometry, flow velocity, channel geometry, fluid property, pipe diameter, and geometry in the vicinity of the pipe. Froude law was used in the modeling. The experiments saw was used in the moderning. The experiments were limited to one bow geometry and barge draft. The diffuser pipe was half buried in the channel floor. The lift and drag coefficients decrease with an increase in the relative submergence of the pipe. For no river flow, the maximum lift and drag coefficients occurred at a Froude number of about 0.7. When flow existed at small pipe submergence, the drag and lift coefficients increased substantially. The forces increased with an increase in the barge width. The hydrodynamic uplift force was estimated as high as 15,000 pounds per linear foot for a half-buried 20-foot diameter pipe in 30 feet of water. (Knapp-USGS) W73-03032

HYDRODYNAMIC PRESSURE OF NONSTA-TIONARY FLOW IN CANALS ACTING ON MOORED SHIPS,

All-Union Designing, Surveying and Scientific Research Inst. Hydroproject, Moscow (USSR). A. V. Mikhailov, and G. F. Onipchenko.

A. V. Mikhailov, and G. F. Onipchenko. In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 117-124, 1972 (release date). 5 fig, 3 ref.

Field 08-ENGINEERING WORKS

Group 8B-Hydraulics

Descriptors: "Hydrodynamics, "Ships, "Canals, "Locks, Drag, Loads (Forces), Waves (Water), Hydraulic models. Identifiers: Ship-canal interactions.

An approximate procedure is given for theoretical determination of hydrodynamic forces acting on ships moored in approach canals of locks when the lock chambers are filling and emptying. Values of these forces obtained in prototype and model studies are compared with theoretical data. (Knapping States)

W73-03033

HYDRODYNAMIC WAVE UPLIFT FORCES ON HORIZONTAL SLABS, Lehigh Univ., Bethelehem, Pa. Dept. of Civil En-

gineering.
O. A. Elghamry.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 125-132, 1972 (release date). 6 fig. 8 ref.

Descriptors: *Waves (Water), *Hydrodynamics, *Surf, *Hydraulics, *Loads (Forces), Channel morphology, Hydrostatic pressure, Beaches, Breakwaters.

Identifiers: *Hydrodynamic uplift.

Hydrodynamic uplift forces and pressures on horizontal slabs are exerted by periodic non-breaking and breaking waves. Time histories of uplift pressures and forces were recorded simultaneously in a laboratory wave channel under a variety of wave conditions and clearances. For the case of no beaches, theoretical solutions are discussed and a modified theory is presented. For waves breaking on 1:3 and 1:5 beach alopes, both weak pressures and forces are of produce to the peak pressures and forces are of random nature and had Gaussian and Rayleigh distributions, respectively. Correlations of the measured mean peak forces with wave characteristics and deck geometry are given. (Knapp-USGS) W73-03034

TRAJECTORY OF FLOATING BODIES IN A STRONGLY DEVIATING FLUID VEIN, CTRAJECTOIRE DE CORPS FLOTTANTS DANS UNE VEINE FLUIDE FORTEMENT DEVIEE), Sherbrooke Univ. (Quebec). Dept. of Civil En-

gineering. M. Vandenbeusch, and B. Gallez.

M. Vandenouszer, and B. Graiez.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971. Volume 2, p 133-139, 1972 (release date). 3 fig, 9 ref.

Descriptors: "Hydraulics, "Spillways, "Check structures, "Flotsam, "Ice, Flumes, Drops (Struc-tures), Model studies, Hydraulic models, Hydrau-

lic design. Identifiers: *Stilling basins.

Floating bodies entrained on steep slopes of spillways may cause damage either by friction or re-peated impacts on the spillway or the stilling basin at the bottom of the spillway. This problem arises with raft-wood flumes and floating ice. The objecwith rati-wood nimes and rolaning ice. Ine objectives are to determine step by step the trajectory of floating bodies in a spillway toe of circular bucket type with both free and submerged streamflow, and to determine the bucket form eliminating or at least diminishing impacts, so that the bottom and its lining are protected. A numerical approach is used in the case of a free streamflow. The fol-lowing hypotheses are used: the streamflow depth lowing hypotheses are used: the streamflow depth is constant on the bucket, and the velocity profile can have any shape which is not modified by the floating body. The following quantities are considered: geometry and dimensioning of the whole spillway, discharge, floating body shape, dimensions and density. The applied forces are evaluations and density. ated experimentally and theoreticaly; then the trajectory is found by a finite-step iterative method. Numerical results are compared with experimental measurements and used to offer a guideline to determine the most convenient shape of the spillway toe. (Knapp-USGS) W73-03035

OPTIMIZED GEOMETRY FOR BAFFLE BLOCKS IN HYDRAULIC JUMPS, Texas A and M Univ., College Station.

D. R. Basco.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Intenational Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 141-148, 1972 (release date). 5 fig, 6 ref.

Descriptors: *Hydraulic jump, *Hydraulic design, Hydraulic models, *Drag, Hydrodynamics, Criti-cal flow, Turbulent flow, Drops (Structures). Identifiers: *Stilling basins.

Knowledge of the drag force on baffle blocks in a hydraulic jump would aid in determining the op-timum block geometry. Highly turbulent and nontimum block geometry. Highly turbulent and non-uniform flow in the jump prevent a theoretical solution to the problem. An experimental technique similar to that employed by aerodynam-icists was used to directly measure the drag forces. Jump length, downstream wave height, and water surface profile were the other optimization criteria of interest. Block location, height, width, spacing, second-row location, and shape were the geome-trical variables investigated. The study was limited to nonsubmerged jumps in wide rectangular. to nonsubmerged jumps in wide, rectangular, horizontal channels. A drag force ratio using the free jump, sequent depth pressure force proved more practical for data correlation than a classical drag coefficient. Resultant downstream water drag coefficient. Resultant downstream water depths computed using the measured drag force compared favorably with experimentally measured values. The maximum drag force in the region of 'best' water surface profile was employed as the optimization criterion and resulted in near optimum jump lengths and downstream wave heights. The results enable the designer to determine the optimum baffle block geometry for Froude numbers from 3 to 10. (Knapp-USGS) W73-03036

THE IMPACT OF THE JET ON THE OBSTA-

CLE, All-Union Designing, Surveying and Scientific Research Inst. Hydroproject, Moscow (USSR). V. M. Ljatkher, and V. V. Dzugaev. In: Hydraulic research and its impact on the enterprise of International Proceedings of 14th Congress of International Conference of International Confe

in: Hydraulic research and its impact on the en-vironment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 149-157, 1972 (release date). 10 fig, 6 ref.

Descriptors: *Jets, *Hydrodynamics, *Spillways, *Hydraulics, Drops (Structures), Hydraulic *Hydraulics, Drops (Structures), design, Overflow, Erosion control. Identifiers: *Impact (Jets).

A solution is given for the impact of a jet consist-ing of separate masses into which the jet is broken when falling, as well as the whole jet on a rigid obstacle covered with a layer of water of finite depth. Fluid is assumed to be nonviscous and incom-pressible. The boundary problems are solved by the complex variable functions theory. As a result, distribution of the instantaneous values of velocity and impulse pressure on the surface upon which the jet acts is obtained. The total value of the initial impulse acting on the surface at the moment of tial impulse acting on the surface at the moment of the impact is calculated. Consideration is given to distribution of velocity and impulse pressure on the obstacle surface and to variation of the virtual mass coefficient with the angle of inclination. Besides the influence of dimensions of the separate parts of the jet as a whole, effects of the relative depth of the underlying fluid layer are also calculated. (Knapp-USGS) W73-03037

THE MAGNITUDE OF SHEAR STRESSES ACT. ING ON THE BOTTOM OF OPEN CHANNELS BY PROPAGATING SURGE WAVES, Slovenska Akademie Vied, Bratislava (C-zechoslovakia). Ustav Hydrologie a Hydrauliky.

V. Strauss.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 159-167, 1972 (release date). 5 fig, 7 ref.

Descriptors: *Surges, *Hydraulic models, *Open channel flow, *Instrumentation, *Shear stress, Drag, Unsteady flow, Waves (Water), Wave pile-up, Supercritical flow.

Direct measurement of shear stresses acting on the wetted area of a channel may be made when investigating non-steady flow in laboratory conditions. It is not possible to use the devices developed for shear stresses measurement in a steady flow for measurement of shear stresses in a non-steady flow. The conditions which the devices must fulfill in order to be able to measure the shear stresses in non-steady conditions are discussed. Taking into consideration these conditions, a new method was developed which can be used for direct measurement of the time course of shear stress at the point of the wetted area in non-steady conditions. The principle of the device, the measurement procedure, and a special calibration method by means of the continuous change of the acting force are given. (Knapp-USGS)

FORCES EXERTED ON SMALL STRUCTURES BY A FLUID WITH A FREE SURFACE IN AL-TERNATING MOVEMENT (EFFORTS EX-ERCES PAR UN FLUIDE A SURFACE LIBRE EN MOUVEMENT ALTERNATIF SUR DES STRUCTURES FINES), Ljubljana Univ. (Yugoslavia). Dept. of Civil En-

J. Bleiweis, and G. Chabert D'Hieres.

J. Bieweis, and G. Chabert D. Hieres. In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 169-176, 1972 (release date). 5 fig, 4 ref.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Roughness (Hydraulic), *Ships, *Unsteady flow, Model studies, Hydrodynamics, Hydraulics, Uniform flow, Non-uniform flow

In marine model techniques, the roughness of the In marine model techniques, the roughness of the model is generally represented by roughness elements producing an energy absorption corresponding at model scale to the energy absorption of the prototype. If the number of elements is computed assuming conditions of uniform flow, the roughness will usually be too large for the actual alternating flow in the model. This difference of loads sustained by a roughness model in alternating flow and in uniform flow led to an experimental study to find, quantitatively, the energy dissipation losses. (Knapp-USGS)

FRICTION FORCES OF UNSTEADY FLOWS IN OPEN CHANNELS AND PIPES, Institut Gidrodinamiki, Novosibirsk (USSR). O. F. Vasiliev, and V. I. Kvon. In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Intenational Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 187-196, 1972 (release date). 5 fig, 11 ref.

Descriptors: *Fluid friction, *Open channel flow, *Pipe flow, Turbulent flow, Boundary layers, Unsteady flow, Non-uniform flow, Drag, Flow re-

Unsteady mean t ing a two-dimensi a uniform flow in nalysis of the fl classical principle and the semi-emp Kaman. In the pig tion was used, pa varied according hydraulic calcula and open channel determined from assumption of sis, it is necessar of unsteady flow velocity and shear W73-03041

MECHANICAL ARY FLOW OF AND THROUGH Politeknicheskii I R. R. Chugaev. In: Hydraulic res vironment, Proces national Associa Paris, August 29-197-204, 1972 (rele

Descriptors: *Tu Turbulence, Drag Non-uniform flow

An analysis is give stationary flow or porous body, co-ments which are i points or along im tion the magnitud a model of a c polygon represent fluid contained in volume. The same lent motion. Empl W73-03042

HYDRAULIC DO FORCES, Water Research In P. Horeni. ln: Hydraulic res vironment; Procee national Associa

Paris, August 29-5 205-211, 1972 (rele Descriptors: *Co *Penstocks, *Ga Model studies, Hy

In a peak power stock coaster gat profile of the turb e shape of a leaf lip both on the up tons (metric), clo operates in a pres The critical state f moment when the uplift force alway iderably affected aperture between insure the correct resultant force ac downwards. Duris even in the corr rhythmical vertical curred which mad function of the gat ments are addition outflow below the Insteady mean turbulent motions of fluid includ-Justeady mean turbulent motions of fluid includ-ing a two-dimensional flow in an open channel and uniform flow in a circular pipe are analyzed. The nalysis of the flow in a channel is based on the lassical principles of the boundary layer theory and the semi-em-trical turbulent theory of Prandul-Compa. In the pipe flow a turbulence energy equaand the semi-emi-virical turbulent theory of Prandti-caman. In the pi₁e flow a turbulence energy equa-ion was used, particularly when fluid discharge is arried according to a harmonic law. In practical ydraulic calculations of unsteady flows in pipes and open channels the friction resistance is usually elermined from the relations for steady motion assumption of quasistationarity. To evaluate heoretically the degree of validity of this hypothe-ist is necessary to study in detail the structure. neorements are degree or vanaunty or tails hypothe-is, it is necessary to study in detail the structure of unsteady flows (in particular, distribution of elocity and shear stress). (Knapp-USGS) 973-03041

MECHANICAL ACTION OF NON-STATION-RY FLOW OF WATER ON POROUS BODIES ND THROUGH STRUCTURES, biteknicheskii Institut, Lenizrad (USSR).

knicheskii Institut, Lenigrad (USSR).

voliteknichesku institut, Lenigrad (USSK).

2. R. Chugaev.

a: Hydraulic research and its impact on the en-rironment, Proceedings of 14th Congress of Inter-tational Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 97-204, 1972 (release date). 6 fig, 5 ref.

Descriptors: *Turbulent flow, *Porous media, furbulence, Drag, Hydrodynamics, Hydraulics, Non-uniform flow, Unsteady flow.

An analysis is given of the forces exerted by a nontationary flow on a group of solid bodies or on a sorous body, composed of individual solid ele-nents which are in contact either at mathematical soints or along impervious areas. For laminar monon the magnitude of the forces is estimated from a model of a continuum by drawing a force polygon representing the dynamic equilibrium of hid contained in the pores of a given elementary rolume. The same problem is analyzed for turbuent motion. Emphasis is placed on the distinctive characteristics of turbulence. (Knapp-USGS) W73-03042

HYDRAULIC DOWNPULL INCREASE AT A DAM GATE CAUSED BY HYDRODYNAMIC PORCES,

Water Research Inst., Prague (Czechoslovakia).

P. Horeni. In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 205-211, 1972 (release date). 4 fig, 3 ref.

Descriptors: *Coaster gates, *Hydrodynamics, Penstocks, *Gate seats, *Hydraulic design, Model studies, Hydraulic models.

in a peak power plant with four turbines a pentock coaster gate is used for closing the inlet
profile of the turbine penstock. The gate body has
the shape of a leaf with peripheral sealing and the
ip both on the upstream face. The gate weighs 60
ons (metric), closes an opening 3 x 9 m and
operates in a pressure head range from 31-55 m.
The critical state for gate equilibrium arises at the
moment when the penstock is completely filled
and the water begins to fill the gate shaft. The
upilif force always tends upwards; its value increases with increasing discharge, and is considerably affected by the size of the connecting
aperture between the penstock and gate shaft. To
insure the correct function of the gate, the total
resultant force acting upon the gate must tend resultant force acting upon the gate must tend downwards. During the filling of the penstock sowmards. During the Illing of the penstock even in the correct manner of manipulation, rhythmical vertical movements of the gate oc-curred which made impossible the normal filling function of the gate. The primary causes of move-ments are additional uplift forces arising at the outflow below the gate. The problem was solved

by model tests and prototype measurements. With repair of the gate, an improved design of the lower wall was used which insured sufficiently great additional hydrodynamic downpull of the gate and prevented its vertical oscillations. (Knapp-USGS) prevented in W73-03043

THEORETICAL STUDY ON FLAP GATE OSCILLATION,
Peale Polytechnique, Montreal (Quebec).

H-W. Partenscky, and A. Swain.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 213-220, 1972 (release date). 5 fig, 1 tab, 9 ref.

Descriptors: *Hydraulic design, *Gates, *Virbrations, *Critical flow, Resonance, Overflow, Mathematical studies, Hydrodynamics, Fluid Identifiers: *Flap gates.

The vibration of elastically suspended flap gates under critical overflow conditions was analyzed mathematically in considering the mutual effects of the three coupled members in the system: the oscillating water nappe, the air volume enclosed between the flap gate and the water curtain and the moveable gate having structural elasticity. The differential equations governing the couples oscilla-tion of the system are derived and the general solutions presented in matrix form. The analysis allows the determination of the basic frequency of oscillation for the system as well as that of an observed beat effect. The validity of the general solutions obtained from the analysis was checked by means of systematic measurements at a model gate in different operating positions and under variable flow conditions. By using the characteristic values of the model gate system, it was possible to predict the resulting frequency of oscillation for the different operating conditions. The recorded frequencies were in good agreement with the theoretically predicted values. The results of the model tests are presented in non-dimensional diagrams which may be used for the design and operation of elastically suspended flap gates. (K-napp-USGS) W73-03044

HYDRODYNAMIC FORCES CAUSED BY UN-STEADY SLOT FLOW ON VERTICAL LEAF GATES, Central Water and Power Research Station, Poona

(India). C. P. Venkataraman, and C. V. Gole.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paria, August 29-September 3, 1971, Volume 2, p 221-227, 1972 (release date). 7 fig. 3 ref.

Descriptors: "Hydraulic design, "Gates, "Un-steady flow, "Loads (Forces), Spillway gates, Hydrodynamics, Fluid mechanics. Identifiers: "Leaf gates, "Koyna Dam (India).

Physical aspects are described of unsteady flow within the slots of a fixed wheel gate with upstream skin plate and seals. The circulation of flow which causes the hydrodynamic downpull on the gate is influenced by the presence of guides, the dimensions of the drain holes on the gate and also by the leakage at the top seal. Model tests on cerby the leakage at the top seal. Model tests on cer-tain designs led to a novel and simple device called 'slot flow arresters' by means of which a reduction of about 85 percent of the downpull was achieved. This device has been successfully used on the pen-stock intake gate of the Koyna Dam in India. (K-reser, 11852) napp-USGS) W73-03045

HYDRODYNAMIC FORCES ON SINGLE IN-TAKE GATES,
Worcester Polytechnic Inst., Holden, Mass.

Worcester Polytechnic Inst., Holden, Mass. G. E. Hecker, and R. A. Elder.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 229-238, 1972 (release date). 10 fig.

Descriptors: "Hydraulic models, "Intake gates, "Slide gates, "Hydrodynamics, "Loads (Forces), Hydraulic design, Analog models, Friction, Bearings, Tennessee Valley Authority.

Model tests were conducted for a prope bine intake and gate for TVA's Tims Ford project. The tests were to insure that a complete emergency closure could be made at flows up to the runaway discharge. These tests included an inrestigation of the effects on the hydrodynamic and cable forces of varying intake geometry, lower gate lip angle, speed of gate closure, gate friction, initial discharge, and quantity of air venting. Online analog computer components were used to eliminate the known model friction variation. From this, prototype cable forces were computed for a range of expected gate friction coefficients. Some of the design parameters, such as the intake shape and gate friction, had pronounced effects on such as speed of closure and air-venting, had no major effects. (Knapp-USGS) W73-03046

HYDRODYNAMIC FORCES DUE TO NONSTA-TIONARY OSCILLATIONS OF CYLINDRICAL SHELLS IN A FLUID MEDIUM WITH DEFOR-MATIONS OF THE CROSS-SECTION TAKEN

MATIONS OF THE CROSS-SECTION TAKEN INTO ACCOUNT, Vscsoyuznyi Nauchno-Issledovatelskii Institut Gidrotekhniki, Leningrad (USSR). L. S. Sheinin, and I. S. Zbulyova.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 239-246, 1972 (release date). 4 fig, 1 tab, 8 ref.

Descriptors: "Hydrodynamics, "Flow around ob-jects, "Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

Nonstationary oscillations of a vertical circular-cylindrical shell in an infinite horizontal layer of an ideal homogeneous compressible fluid bounded by the free surface and by the horizontal absolutely rigid impervious bottom are analyzed with deformations of the shell cross-section taken into acsidered. A general solution both in an integral form and in series is presented for an arbitrary nonsta-tionary law of the shell motion. For some laws of motion, a closed solution is derived, which yields the hydrodynamic pressure and velocities at any point of a water medium as well as the effect of variations in geometrical dimensions, predominant forms of oscillations, and other factors. Graphs are given illustrating the results and facilitating practical calculations. In all the cases condisered the ratio of the hydrodynamic pressure to the acceleration increases in time tending asymptotically to the magnitude typical of an incompressible fluid but never exceeding it. (Knapp-USGS)

NATURAL VIBRATIONS OF CYLINDRICAL SHELLS IN A MOVING FLUID (VIBRATIONS PROPRES DE COQUES CYLINDRIQUES EN PRESENCE DE FLUIDE),
Laboratoire National d'Hydralique, Chatou

F. Boulot, and A. Warluzel.

Field 08-ENGINEERING WORKS

Group 8B-Hydraulics

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 247-253, 1972 (release date), 3 fig, 9 ref.

Descriptors: *Hydrodynamics, *Flow around ob jects, *Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

A numeric analysis uses a Galerkin method to determine natural vibrations of cylindrical shells in a moving fluid; the fluid is inside or outside the shell or the shell can be immersed only partially. At the ends of the shell the conditions usually met in practice are taken into account: the ends may have clamps, simple supports to be free. A com-puter program gives results in good agreement with experimental results on a steel shell. (Knapp-USGS) W73-03048

ON HYDROELASTIC CORRELATIONS BETWEEN DIFFERENT FORMS OF OSCILLA-TIONS OF PLATE IN THE FLOW BOUNDARY RESULTING FROM NON-UNIFORM DISTRIBUTION OF AVERAGED FLOW TRIBUTION OF AVERAGED
VELOCITY IN DEPTH,
Vsesoyuznyi Nauchno-Issledovatelskii

Institut Vodosnabzheniya, Kanalizatsii, nicheskikh Sooruzhenii Gidrogeologii, Moscow (USSR). P. E. Ljisenko. Gidrotekh-Inzhenernoi

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 255-262, 1972 (release date). 3 fig, 2 ref.

Descriptors: *Hydrodynamics, *Flow around objects, *Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

The forms of hydroelastic interactions between flow and structure are analyzed. A component of interaction between the pulsation field induced by the oscillation of structures and the averaged velocity field creates feedback of oscillation and changes the form of transfer functions, leading to suppression of low resonances and to formation of higher ones. The maximum of transfer function in this case may be much greater than it would be without hydroelastic interaction. (Knapp-USGS) W73-03049

INVESTIGATION OF NONSTATIONARY HYDRODYNAMIC FORCES INDUCED BY A PLATE OSCILLATING IN LIQUID FLOW (T-WO-DIMENSIONAL PROBLEM),

WO-DIMENSIONAL PROBLEM),
Yeseoyuznyi Nauchno-Issledovatelskii Institut
Gidrotekniki, Leningrad (USSR).
A. S. Abelev, and L. L. Dolnikov.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research,
Paris, August 29-September 3, 1971, Volume 2, p
263-270, 1972 (release date). 4 fig, 9 ref.

Descriptors: Hydrodynamics, *Flow around objects, *Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics, *Gates.

An investigation is described on nonstationary hydrodynamic loads due to oscillations of a plate in liquid flow taking into account the effect of the random component of turbulent pulsations of the hydrodynamic load on the operation of a sub-merged vertical-lift gate. Presented are results of a theoretical analysis of the conditions of the existence of auto-oscillations of the plate as well as relevant experimental findings. (Knapp-USGS) W73-03050 A METHOD UTILIZING AN INTEGRAL FOR-MULATION OF PROBLEMS OF NATURAL VIBRATIONS OF SHELLS IN THE PRESENCE OF AN INCOMPRESSIBLE FLUID (A PROPOS D'UNE METHODE UTILISANT UNE FORMU-LATION INTEGRALE DU PROBLEME DE VIBRATIONS PROPRES DE COQUES EN PRESENCE D'UN FLUIDE INCOMPRESSIBLE, Laboratoire National d'Hydralique, Chatou

(France).
F. Boulot, and A. Warluzel.
In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Intenational Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 271-277, 1972 (release date). 1 tab, 10 ref.

Descriptors: *Hydrodynamics, *Flow around objects, *Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

One difficulty of shell natural vibrations problem in the presence of fluid comes from the added dimension needed in analysis. Assuming the fluid dimension needed in analysis. Assuming the fluid to be perfect, velocity potential can be written as a simple layer potential of an unknown density on the shell surface. An integro-differential system may be calculated on this surface, gaining one dimension. As an example, this theory was used for a rectangular plate clamped on its edges and in contact on one of its faces with water. Comparison between calculated and measured results is good for lowest modes. (Knapp-USGS)

DAMPING OF NATURAL VIBRATIONS OF AN IMMERSED CYLINDRICAL SHELL WITH FREE ENDS: INFLUENCE OF CONFINEMENT FREE ENDS: INFLUENCE OF CONFINEMENT
OF THE FLUID BY AN AXIAL SHELL (AMORTISSEMENT DES VIBRATIONS PROPRES
D'UNE COQUE CYLINDRIQUE IMMERGEE ET
LIBRE A SES DEUX EXTR EMITES: INFLUENCE DU CONFINEMENT DU FLUIDE
PAR UNE COQUE AXIALE),
Laboratoire National d'Hydralique. Chatou

(France).

F. Boulot, and A. Warluzel.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of International Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 279-286, 1972 (release date). 3 ref.

Descriptors: *Hydrodynamics, *Flow around objects, *Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

In the case of a thin shell with free ends, axial dimension is supposed to have no effect on the vibration phenomenon. Fluid is incompressible, viscous, and Navier - Stokes equations are linearized. Expressions of pressure and shear stress are introduced in dynamic equations of the shell. Fluid is limited by coaxial shell. In assuming the Reynolds number, a function of the shell radius, to be much higher than one (which is the case in practice) a literal expression of damping is given. (Knapp-USGS)

STUDY OF VISCOUS HYDRAULIC DAMPING OF BREATHING VIBRATIONS OF A CYLIN-DRICAL SHELL IN A FLUID AT REST (ETUDE DE L'AMORTISSEMENT HYDRAULIQUE VISQUEUX DES VIBRATIONS DE RESPIRA-TION D'UNE COQUE CYLINDRIQUE DANS UN FLUIDE AU REPOS), L. Levin, and D. Milan.

In: Hydraulic research and its impact on the environment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 287-293, 1972 (release date). 5 ref. Descriptors: *Hydrodynamics, *Flow around objects, *Vibrations, *Laminar flow, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

The typical equations for the vibrations with breathing of a thin cylindrical shell free at the ends, plunged into a viscous fluid at rest, are established, in the case of the induced laminar established, in the case of the induced laminar flow, for Reynolds numbers much higher than one. The comparison of experimental results with theory shows that, in the range of low frequencies, it can be assumed during vibrational tests of shells in a fluid that the induced motion is laminar. (K-

STUDY OF THE HYDRAULIC DAMPING OF THE VIBRATIONS OF A ROD IN THE TURBU-LENT REGIME (ETUDE DE L'AMORTISSE-MENT HYDRAULIQUE DE LA VIBRATION D'UNE BAGUETTE EN REGIME TURBULENT), L. Levin, and A. Meaulle. In: Hydraulic research and its impact on the en-

in: Hydraulic research aim is impact on the en-vironment; Proceedings of 14th Congress of Inte-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 295-302, 1972 (release date). 3 fig. 2 ref.

Descriptors: *Hydrodynamics, *Flow around objects, *Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

Tests were made on damped free vibration in-duced in nuclear reactor rods in flowing fluid. The initial amplitudes are sufficiently important for use of a quadratic friction equation in terms of the velocity. A method is indicated to calculate the turbulent damping factor and the influence of the flow velocity is studied. (Knapp-USGS) W73-03054

CRITICAL WATER DEPTH FOR HYDRODYNAMIC INDUCED OSCILLATION OF CANTILEVERED CYLINDERS, Zagreb Univ. (Yugoslavia). J. Greic.

In: Hydraulic research and its impact on the enni: Hydraulic research and its impact on the en-vironment; Proceedings of 14th Congress of Inte-national Association for Hydraulic Research, Paris, August 29-September 3, 1971, Volume 2, p 303-312, 1972 (release date). 10 fig, 5 ref.

Descriptors: "Hydrodynamics, "Flow around ob-jects, "Vibrations, Unsteady flow, Non-uniform flow, Drag, Velocity, Elasticity (Mechanical), Hydraulic design, Hydraulics.

A partially immersed cantilevered cylindrical body in flow-induced vibration oscillates with its largest displacement at a certain 'critical water-depth'. In displacement at a certain critical water-depth. In this condition the energy absorbed by the oscillating cylinder is larger than that dissipated by structural damping. Two different behaviors of the change of frequency with increases in immersion are observed. The physical properties influencing mechanical hysteresis and internal friction have a dominant influence to the damping capacity. (K-napp. IJSGS) napp-USGS) W73-03055

HYDRODYNAMIC FORCES ACTING ON SONIC OSCILLATORS IN SONIC TRANSMIS-SIONS (FORCES HYDRODYNAMIQUES AGIS-SANT SUR LES OSCILLATEURS SONIQUES DANS LES TRANSMISSIONS SONIQUES), Institute of Hydrotechnical Research, Bucharest

A. Maruta

A. Marua. In: Hydraulic research and its impact on the en-vironment; Proceedings of 14th Congress of Inter-national Association for Hydraulic Research,

Paris, August 29-S 313-319, 1972 (relea

Descriptors: *Hydects, *Vibrations jects, *Vibrations waves, Unsteady i Velocity, Elastic design, Hydraulics

Problems of hydro ors and receiver devices are analyz form of their variatelesticity and in characteristics. (Kill W73-03056

APPROXIMATE (
MALLY STRATII
RY LAYER IN A SHARP CHANGE THE SURFACE PLACE, I. K. Nikitin. Fluid Mechanics-S 177-184, July-Augu

Descriptors: *Fluid boundary layers
*Roughness (Hyd perature, Bodies of tions, Variability, I Identifiers: USSR

A method is presen boundary layer for takes place downst ess. Experie fect of free-stream bles. Allowance is lence and thermal s (Josefson-USGS) W73-03058

CONCERNING VE TURBULENT FLO A. G. Baskakova, V Pereverzev. Fluid Mechanics-S 173-176, July-Augu

Descriptors: *Fluid balent flow, *Velo boundary layers, S sure, Compressibili Identifiers: USSR, Tangential stress.

two-dimensional incompressible flui ection or suction obtained for veloc boundary layer, ba pulsational velocit polynomial expres stress in the cross W73-03059

THE STRUCTURE ADJACENT TO W. S. S. Kutateladze. Fluid Mechanics-Se -11, July-August 19

Descriptors: *Fluid *Turbulence, *Bo (Surfaces), Streams Flow, Velocity, I Aqueous solution Histograms, Equati Identifiers: USSR,

Hydraulic Machinery-Group 8C

aris, August 29-September 3, 1971, Volume 2, p 3-319, 1972 (release date), 4 fig. 2 ref.

escriptors: "Hydrodynamics, "Flow around ob-cts, "Vibrations, "Sonar, "Acoustics, Sound aves, Unsteady flow, Non-uniform flow, Drag, clocity, Elasticity (Mechanical), Hydraulic sign, Hydraulics.

oblems of hydrodynamic forces on sonic oscilla-rs and receivers and on sonic transmission vices are analyzed. Theoretical analysis shows at these forces are variable. The value and the rm of their variation depends on their resistance, saticity and inertia, and also transmission arracteristics. (Knapp-USGS) 73-03056

PROXIMATE CALCULATION OF A THER-ALLY STRATIFIED TURBULENT BOUNDA-Y LAYER IN A REGION DOWNSTREAM. A HARP CHANGE IN THE ROUGHNESS OF HE SURFACE AT WHICH FLOW TAKES

ACE, K. Nikitin. uid Mechanics-Soviet Research, Vol 1, No 4, p 7-184, July-August 1972. 5 fig, 6 ref.

escriptors: "Fluid mechanics, "Flow, "Turbulent nundary layers, "Thermal stratification, toughness (Hydraulic), Drag, Velocity, Tem-trature, Bodies of water, Surfaces, Cross-sec-nos, Variability, Model studies, Equations. entifiers: USSR, Velocity distribution, Kine-

method is presented for calculating the turbulent bundary layer forming on a surface at which flow kes place downstream from a change in surface ughness. Experimental data are given on the efct of free-stream turbulence on wall flow varia-es. Allowance is made for the effect of turbu-nce and thermal stratification in wall flow layers. osefson-USGS)

ONCERNING VELOCITY DISTRIBUTIONS IN URBULENT FLOW AT POROUS SURFACES, G. Baskakova, V. T. Movchan, and A. M. sreverzev. luid Mechanics-Soviet Research, Vol 1, No 4, p 3-176, July-August 1972. 3 fig, 7 ref.

escriptors: *Fluid mechanics, *Kinetics, *Tur-ulent flow, *Velocity, *Porous media, Turbulent undary layers, Surfaces, Energy, Stress, Pres-rec, Compressibility, Injection, Equations. lentifiers: USSR, Prandtl velocity distribution, angential stress

two-dimensional turbulent gradient flow of an compressible fluid along a porous surface with jection or suction is considered. An expression is jection or suction is considered. An expression is bained for velocity distribution in a turbulent pandary layer, based on the Prandtl hypothesis r dependence of frictional stress on energy of islational velocity components and on the plynomial expression for tangential frictional ress in the cross section of a boundary layer. 73-03059

HE STRUCTURE OF TURBULENT FLOWS

DIACENT TO WALLS, S. Kutateladze. hid Mechanics-Soviet Research, Vol 1, No 4, p 11, July-August 1972. 14 fig.

escriptors: "Fluid mechanics, "Turbulent flow, lurbulence, "Boundary layers, "Boundaries lurfaces), Streams, Viscosity, Reynolds number, low, Velocity, Porous media, Shear stress, gueous solutions, Polymers, Fluctuations, istograms, Equations, lentifiers: USSR, Space-time characteristics.

A translation is presented of Chapter 8 of Part II of Academician S. S. Kutateladze's lectures on wall turbulence, delivered at Novosibirsk State University. Discussed are: (1) the viscous sublayer; (2) the turbulent core of a boundary layer; (3) space-time correlation functions; (4) the effect of adding structuring agents to water; and (5) the structure of a boundary layer on a porous plate beyond the point of detachment. (Josefson-USGS)

EXPERIMENTAL STUDY OF THE STRUC-TURE OF TURBULENT BOUNDARY LAYERS IN INCOMPRESSIBLE FLUIDS IN THE IN INCOMPRESSIBLE FLUIDS IN THE PRESENCE OF A LONGITUDINAL PRESSURE GRADIENT,
A. G. Marchenko.
Fluid Mechanics-Soviet Research, Vol 1, No 4, p 166-172, July-August 1972. 5 fig, 1 tab, 4 ref.

Descriptors: "Fluid mechanics, "Flow, "Turbulent boundary layers, "Pressure, "Compressibility, Roughness (Hydraulic), Velocity, Reynolds number, Shear stress, Boundaries (Surfaces), Sur-faces, Ducts, Tunnels, Fluctuations, Equations. Identifiers: USSR, Velocity distribution, Pressure gradient, Tangential stress, Kinematics.

The physical pattern of flow in turbulent boundary layers in incompressible fluids developing at inlet sections of flat converging and diverging ducts with smooth and rough walls is described. Data are presented on the distribution of average and pul-sating flow velocities and Reynolds shear stresses in boundary-layer sections with positive and negative pressure gradients. Features of the kinematic structure of these flows are considered. (Josefson-USGS) W73-03061

ON THE EQUILIBRIUM OF A CABLE CON-NECTED TO A FREE-FLOATING BODY PLACED IN A STREAM, V. I. Bukach, and I. M. Gorban.

Fluid Mechanics-Soviet Research, Vol 1, No 4, p 149-154, July-August 1972. 3 ref.

Descriptors: *Fluid mechanics, Stepuilbrium, *Floating, Floats, Flow, Bouyancy, Submergence, Depth, Variability, Equations. Identifiers: USSR, *Cables.

The geometry of a flexible cable between a float-ing body and a fixed point on a streambed is alyzed. Approximate analytical expressions are obtained for drift and submergence of a body in a plane-parallel flow with nonuniform depth. A curve is given for determining the angle between the cable and horizon at any point along the cable. (Josefson-USGS) W73-03062

AERATION OF WEIRS, College of Engineering, Madras (India). Dept. of Hydraulic Engineering. R. Sakthivadivel, and S. Seetharaman.

Irrigation and Power (India), Vol 29, No 2, p 177-186, April 1972, 9 fig. 1 tab. 8 ref.

Descriptors: *Weirs, *Aeration, *Discharge coefficient, *Stage-discharge relations, Discharge measurement, Calibrations, Overflow.

e direct result of insufficient aeration of overfall weirs is the reduction of pressure beneath the nappe and this in turn may cause both desirable and undesirable effects. Among the undesirable effects, the first is an increase of pressure difference on the weir itself which may increase the rerence on the were used when may increase the resultant load on the structure to the point of failure. The second effect is the change in position of the nappe causing the nappe to fluctuate or pulsate which is very objectionable from the point of view of discharge measurement. Thirdly, there is a change in discharge due to an increase in the discharge coefficient. The desirable aspect of in-sufficient aeration is that spillway discharges can be increased considerably and safely by designing be increased considerably and safely by designing for sub- atmospheric pressures beneath the nappe. A hydraulic model showed that with atmospheric pressure below the nappe, the coefficient of discharge increases with increasing head over the weir and agrees well with Rehbock's formula. The pressure changes below the nappe profile changes the trajectory of the nappe but does not have any effect either on the head causing flow over the weir or on the thickness of the nappe over the weir creats. The coefficient of discharge increases with decreasing pressure below the nappe. (Knappedecreasing pressure below the nappe. (Knappedecreasing pressure below the nappe. creasing pressure below the nappe. (Knapp-IISGS)

SOLUTION OF CONTINUITY AND MOMEN-TUM EQUATIONS OF A TRAVELLING HYDRAULIC JUMP BY USING AN ITERATIVE OPERATOR. B. R. Madhok

Irrigation and Power (India), Vol 29, No 2, p 187-195, April 1972, 8 fig. 2 ref.

Descriptors: *Hydraulic jump, *Computer programs, *Continuity equation, Numerical analysis, Waves (Water), Critical flow, Surges, Transition

Across a hydraulic jump the equation of continuity and equation of momentum hold good, but the equation of energy does not hold good because equation of energy dues not not ago to because there is energy defect across a hydraulic jump. A flow diagram for framing a computer program to solve the equations in order to determine values of h and u at different intervals is given. The computer results are numerical solution of the continuity and momentum equations of the jump. (Knapp-USGS) W73-03150

8C. Hydraulic Machinery

NEW APPROACH TO EFFICIENCY GUARANTEES, Hydro-Electric Commission, Tasmania.

Water Power, Vol 24, No 6, p 206-207, June 1972. 1 fig. 4 ref.

Prototype tests, On-site tests, Economics, Hydraulic machinery, Evaluation, Design criteria. Identifiers: *Turbine efficiency, Test results, *Efficiency guarantees, Acceptance tests, Tasmania (Australia). Descriptors: *Hydraulic turbines, *Model tests,

The efficiency of a hydroelectric plant is an impor-tant economic consideration. Guarantees given for unit economic consideration. Guarantees given for prototype efficiency of hydraulic turbines, therefore, becomes a commercial matter, subject to commercial pressures. Expected prototype efficiency can be derived from model test results by applying a majoration formula. Effective application of such a formula is uncertain, however, since validation of any majoration procedure is difficult to obtain because of limited accuracy of prototype tests. The suggested alternative, a guarantee based tests. The suggested atternative, a guarantee based on model tests, offers the following advantages: (1) The efficiency guarantee is proved early in the contract while changes are still possible; (2) model test accuracy is high and usually can be substantiated; (3) no problems are encountered in achieving guarantee operating conditions or by disrupting commercial operations for on-site tests; (4) model guarantees are devoid of commercial influence; and (5) test results can provide information for other design features. (USBR) W73-02842

TRANSMISSION GOALS: MAXIMUM RATING WITH MINIMUM ENVIRONMENTAL IMPACT,

Field 08-ENGINEERING WORKS

Group 8C—Hydraulic Machinery

Electrical World, Vol 117, No 11, p 35-44, June 1972. 3 illus, 11 photo, 12 dwg, 4 chart.

Descriptors: "Transmission (Electrical), "Extra high voltage, Environmental effects, Costs, Substations (Electrical), Transmission lines, Transmission towers, Insulation.

Identifiers: "Ultra high voltage, Interconnected systems, Underground transmission lines, Underground cables, Noise, Waltz Mill Project (Pennsylvania), USSR, Canada, Great Britain, Gas-insulated cables, Cryogenic cables, Environmental Policy.

mental Policy.

Research and development in the electric power transmission field is focusing on levels above 1000 kv for high transfer capability on acceptable overhead routes, and on EHV cable systems for future undergrounding. Foreign and domestic design of transmission lines and towers in the EHV range are discussed. Studies have been made of the possibility of upgrading existing EHV circuits into the UHV range. The Soviet Union is building lower-voltage regional networks first, then considering the best voltage level for interregional tes. In the US, and plans have been made by the utilities to move into the UHV range. Growing concern among transmission engineers that this move be made soon has led to research at the Waltz Mill Test Station. To minimize environmental impact, greater care is being exercised in route selection, restraining clearing and trimming, and planting of low growing trees and shrubs on rights of way. Underground transmission is also being studied extensively. Substations in the EHV and UHV ranges will require a substantial part of total transmission costs. (USBR)

FURTHER CONSIDERATIONS ON THE DYNAMIC BEHAVIOUR OF HYDRAULIC TUR-

BOMACHINERY, Ente Nazionale per l'Energia Elettrica, Rome (Ita-

ly). M. Fanelli. Water Power, Vol 24, No 6, p 208-222, June 1972. 12 fig, 8 ref, append.

Descriptors: *Hydraulic turbines, *Hydraulic machinery, Dynamics, Behavior, *Mathematical models, Fluctuation, Analysis, Discharge (Water), Head (Fluid mechanics), Vibration, Turbine run-

ners, Unsteady flow. Identifiers: Italy, Impedance, Wicket gates, Spiral

The study of unsteady motion in dydraulic circuits is 2-fold: (1) determining the point at which distrubances are generated, internally or externally to the system; and (2) determining the response of the hydraulic system as a whole (and of all components) to disturbances. A mathematical model representing the dynamic response of a hydraulic machine is discussed in connection with the study of possible fluctuations of pressures and discharges in the system intake and outlet works. The incidence angle variations on turbine blades is particularly important. Results of a study by Von Karman and Sears of nonstationary behavior of airfoils applied to hydraulic turbines apparently leads to a better model of modifications in the internal motion of a hydraulic machine during fluctuations. (USBR) tuations. (USBR) W73-02846

THE COMING TECHNICAL REVOLUTION IN METER READING, Philadelphia Suburban Water Co., Bryn Mawr. Pa. For primary bibliographic entry see Field 07B. W73-02863

AN EXPERIMENT IN COMPUTER-ASSISTED SUPERVISORY CONTROL OF A WATER DIS-TRIBUTION SYSTEM, General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.

For primary bibliographic entry see Field 04A. W73-02871

8D. Soil Mechanics

THE NATURE AND EXTENT OF PEAT DEPOSITS AND POSSIBLE EFFECTS OF PEAT MINING ON MANMADE FEATURES AND SPRINGS NEAR MESCALERO, NEW MEXICO, Geological Survey, Albuquerque, N.Mex. Pop primary bibliographic entry see Field 04B.

PROBABILITY OF EXCEEDING CAPACITY OF FLOOD-CONTROL SYSTEM AT THE NA-TIONAL REACTOR TESTING STATION,

IDAHO, Geological Survey, Idaho Falls, Idaho. For primary bibliographic entry see Field 04A. W73-02781

STRESSES AND MOVEMENTS IN OROVILLE

Syracuse Univ., N.Y. Syracuse Univ., N. 1. F. H. Kulhawy, and J. M. Duncan. Journal of the Soil Mechanics and Foundations Division, American Society of Civil Engineers, Vol 98, No SM7, p 653-665, July 1972. 11 fig, 2 tab, 9 ref, 2 append.

*Finite element analysis, *Instrumentation, Dam construction, Embankments, Displacements, Motion, Movement, Strain, Soil mechanics, Mass concrete, Poisson ratio, Stress, Stress analysis. Identifiers: Core blocks, Oroville Dam (Ca.), Stress-strain curves. Descriptors: *Cracks, *Fractures, *Earth dams,

Oroville Dam, the world's highest embankment dam, was instrumented with several types of in-strumentation to monitor construction behavior. Results indicated that the embankment performed very well with only small amounts of movement. However, the embankment core block did not per-However, the embankment core block did not per-form satisfactorily and cracked during construc-tion. A finite element analysis, modeling the con-struction sequence and the nonlinear, stress-de-pendent material properties of the embankment soils, is compared with instrumentation results. soils, is compared with instrumentation results. The analysis agreed well with instrumentation results and showed that: (1) the small movements were attributable to the excellent stress-strain characteristics of the embankment soils; (2) significant load transfer occurred from the core to th adjacent coarse zones; and (3) if these results had been available during early design stages, the core block cracking could have been anticipated. (USBR) W73-02849

A RAPID GRAIN SIZE ANALYSIS METHOD, Sherbrooke Univ. (Quebec).
P. C. Aitcin, and C. Poulin.
Journal of Materials, Vol 7, No 2, p 113-118, June 1972. 9 fig. 2 tab, 10 ref.

Descriptors: *Gradation, *Soil tests, Equations, Settling velocity, Soil properties, *Soil Mechanics, Suspended sediments, Test procedures, Evaluation, Soil analysis, Grain sizes, Test equipment, Comparative studies, Hydrometry, Silts, Clays, Nomographs, Fines, Tests, Hydrometers. Identifiers: *Gradation analysis, Test results, Finegrained soils, Canada, Particle diameter, Center of gravity, Time saving.

The grain size curve for soil passing the 200 mesh sieve (silts and clays) is normally determined by the standard hydrometer method, but a considerably faster and more accurate method has been developed. Apparatus needed includes: (1) a scale sensitive to at least 1 mg, (2) a 5- to 10-cu cm diver to lower into the soil-water suspension, (3) a vertically movable platform to hold the scale, and (4) a constant temperature bath to keep the suspension temperature constant. A simplified version of the test procedure is: (1) Prepare soil the same as for hydrometer test. (2) Determine apparent weight of diver. (3) Start test and lower diver to 25-cm depth for a 3-min reading, (4) Remove and wash the diver. (5) Dry and lower diver to 3-, 10- and 25-cm depths for 10-min readings. (6) Remove and wash the diver. (7) Folreadings. (6) Remove and wash the diver. (7) Fol-low steps (5) and (6) again for both 1- and 2-br readings. (8) Calculate the particle diameters with the Casagrande nomograph and the percentage of particles passing by either nomograph or equation. Results have compared excellently with hydrome-ter tests. Test repeatability is also very good. Procedures for determining the volume, center of gravity, and depth of the diver are explained. (USBR) W73-03249

INTERNAL PIPING AND SHEAR DEFORMA-TION VICTOR BRAUNIG DAM - SAN AN-TONIO, TEXAS, National Soil Services, Inc., Houston, Tex; and

San Antonio City Public Service Board, Tex. R. F. Reuss, and J. W. Schattenberg.

R. F. Reuss, and J. W. Schattenberg.
Proceedings, American Society of Civil Engineer
Special Conference on Performance of Earth and
Earth-Supported Structures, Vol I, Part 1, Purdue
Univ., Lafayette, Ind., p 627-651, June 1972. 14
fig, 3 photo, 1 tab.

Descriptors: "Earth dams, "Dam failure, "Dam foundations, "Shear failure, Shear strength, Eagineering geology, Embankments, Pore pressure, On-aite investigations, Stability analysis, Cracking, Clays, Failure surfaces, Sands, Berms, Seepage, Foundation failure, Settlement (Struc-tural), Texas.

Identifiers: Deformable soils, Braunig Lake Dam, San Antonio, Piping (Erosion), Embankment sub-sidence, Dam stability, Shear planes.

After 5 yrs with a full reservoir, the st After 5 yrs with a full reservoir, the sudder cracking and movement of the Braunig Lake Dan near San Antonio, Texas, was quite alarming. The dam is constructed of a homogeneous clay fill compacted to 95% maximum standard density and a horizontal sand drainage blanket. Dam height varies from 10 to 80 ft. Initially, 2 transverse cracks were observed across the embankment crest; several days later, a 600-ft length of the embankment settled 18 is A stabilizing bern was also ment settled 18 in. A stabilizing berm was placed on the downstream portion of the embankmen. Since no cracking or bulging was observed at the toe of the dam, downstream shear failure at shallow depth was considered unlikely; a deep shear-ing failure was considered most probable. An in-vestigation to locate the surface of shear failure An inand pre pressure conditions used piezometers, tilland pre pressure conditions used piezometers, til-meters, slope stakes, electrical resistivity equip-ment, and 3- and 5-in.-dia continuous soil samples, but no shearing zone nor high-pore-pressure zone was found. Subsequent boring of sixty-six 36-in-dia open auger holes revealed piping in thin sand layers several ft below the base of the downstream embankment. The piping caused the adjacent clay to change from stiff to weak; an 0.05-in. failur plane was revealed in the weakened clay. Stability plane was revealed in the weakened clay. Stability analyses are presented. (USBR) W73-03250

8F. Concrete

CONCRETE-POLYMER MATERIALS--FOURTH TOPICAL REPORT, Bureau of Reclamation, Denver, Colo. J. T. Dikeou.

Bureau of Reclamation Report REC-ERC-72-10, Brookhaven National Laboratory Report BNL 50328, Jan 1972. 110 p, 54 fig, 65 tab, 36 ref.

Descriptors Concrete to ty, Material Desalination Concrete Bibliograph Concrete concretes, Structural c

Progress in materials u pregnated c concrete im sequently p ment conc which mon mixing of polymer-co formed by mixture). I success wit for PIC are perature ap ated for ments in du sured. Proc use of st under wate monomer l desalting pl bridge dec tunnel liner W73-02845

> NEW MAT Concrete C 271-276, 33

6 photo, 2 t Construct Fibers, Agg Identifiers: ding ce

Progress in oncrete co potential as existing probuilding ne ments, (2) 1 set cement 2000 are pr and answer ject is pres the country the subject cles publish materials in

8G. Mai

EVALUAT STORAGE Army Mobi ment Cente For primary

Fisheries Engineering-Group 81

Descriptors: Concrete mixes, Concrete pipes, Descriptors: Concrete maxes, Concrete pipes,
Concrete testing, *Concrete technology, Durability, Materials engineering, Construction materials,
Desalination plants, Polymers, Concrete,
Concrete properties, Concrete
Bibliographies.

*Concrete-polymer materials,

Concrete vessels, Impregnation, *Polymer concretes, Monomers, Composite materials, Structural concrete.

Progress in the development of concrete-polymer materials up to June 1971 is reported. Three materials under investigation are: (1) polymer-im-pregnated concrete (PIC-precast portland cement concrete impregnated with monomer which is subsequently polymerized in situ); (2) polymer-cement concrete (PCC-a premixed material, in ment concrete (PCC-a premixed material, in which monomer or polymer is added during the mixing of portland cement concrete); and (3) polymer-concrete (PC-a composite material formed by polymerizing a monomer and aggregate mixture). Investigations to date show the most success with PIC, some promise for PC, and the least success with PCC. Seven monomer systems for PIC are currently under test for normal temperature applications and several are being evaluated for high temperature applications. All monomer PIC systems show remarkable improvemonomer Pre systems and tructural properties com-pared with conventional concrete. Compressive strengths as high as 27,200 psi have been measured. Process technology improvements include use of steam-cured concrete, polymerization under water, and encapsulation methods to reduce monomer losses. PIC is being studied for use in desalting plants, draintile, culvert and sewer pipe, bridge decks, marine applications, and precast tunnel liners and supports. (USBR)

NEW MATERIALS IN CONCRETE CONSTRUC-

Concrete Construction, Vol 17, No 6-7, Part I-II, p 271-276, 333-335, 337-338, 340-342, June-July 1972. 6 photo, 2 tab, 13 ref.

Descriptors: *Cements, *Concrete technology, *Construction materials, *Concrete construction, Fibers, Aggregates, Polymers, Concrete additives, Concrete mixes, Reinforcing materials. Identifiers: Synthetics, Latex, Ferrocement, Ex-

panding cements, Expansive concretes, Polymer concretes, Mesh reinforcements.

Progress in the development of new materials in concrete construction and an evaluation of their potential are presented. Some materials will solve existing problems; others will aid in meeting future building needs. Discussed are: (1) expansive cements, (2) fiber-reinforced concrete, (3) regulatedset cements, (4) synthetic aggregates, (5) polymer latex-modified mortars, and (7) ferrocement. Developments in the use of concrete by the yr 2000 are predicted. A summary of some questions and answers from a recent conference on this subject is presented. Speakers from different parts of the country were chosen for knowledgeability of the subjects discussed. A bibliography of 13 articles published in Concrete Construction on new materials in concrete is included. (USBR) materials 11 W73-03247

8G. Materials

POTABLE EVALUATION OF STORAGE TANKS, Army Mobility Equipment Research and Develop-ment Center, Fort Belvoir, Va. Sanitary Sciences For primary bibliographic entry see Field 05G. W73-02656

CLEANING WATER MAINS WITH FOAM PLUGS-EXPERIENCE AT WASHINGTON, D.

C., District of Columbia Dept. of Sanitary Engineer-ing, Washington. Bureau of Water Services. For primary bibliographic entry see Field 05G. W73-0286.

81. Fisheries Engineering

THE COMPOSITION AND DISTRIBUTION OF THE FISH FAUNA OF THE NAVASOTA RIVER, Texas A and M Univ., College Station. Water Resources Inst.

Resources Inst. E. R. K. Strawn, and W. J. Clark. Available from the National Technical Information Service as PB-213 454, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report 32, August 1972. 120 p, 5 fig, 6 tab, 32 ref, 3 append. OWRR B-010-TEX (1). 14-01-0001-1552.

Descriptors: Fish, "Habitats, "Distribution, "Texas, Drainage, "Fish populations, Fish migration. Identifiers: "Navasota River drainage, Notropis lutrensis, Gambusia affinis, Lepomis macrochirus, Notropis actrocaudalis, N. venustus, Campostoma anomalum, Fundulus notti, Folivaceous, Lepomis marginatus, Amia calva, Lepomis symmetricus, Dionda episcopa, Hybognathys plactius, Etheostoma spectabile.

Twenty-one thousand fish representing 9 orders, 14 families, and 56 species were collected from various habitats of the Navasota River drainage. various natitates of the Navasota River gramage. Some species such as Notropis lutrensis, Gambu-sia affinis, and Lepomis macrochirus were taken throughout the drainage from widely varying habitats. Others, such as Notropis actrocaudalis, N. venustus and Campostoma anomalum, were No ventistus and Campostoma anomanim, were found only a few times in more specialized habitats. Some Austroriparian species, such as Fundulus notti, F. olivaceous, and Lepomis marginatus, apparently reach their western range limits at or near the Navasota drainage. Other east Texas and coastal plains fishes such as Amia calva and Lepomis symmetricus reach their western in-land limits at or near the Navasota drainage. Some land imits at or near the Navasota dramage. Some species, such as Dionda episcopa, Hybognathus plactius, and Etheostoma spectabile, are found in more western drainages but are absent from the Navasota drainage. It is suggested that some of these fish distributions are the result of immigration or stream piracy. Proposed water develop-ment projects for the Navasota River include the construction of dams. If these dams are constructed, changes in the fish populations are sure to occur. This study should contribute basic infor-mation from which the effects of future water development can be evaluated. (Runkles-Texas) W73-02613

DETERMINATION OF OPTIMAL PROPORTIONS OF NITROGEN AND PHOSPHORUS CONTENTS USED FOND FERTILIZATION, (IN RUSSIAN),
A. A. Astafurova, L. P. Petinova, and G. N.

Tr Sentr Nauchno-Issled Inst Osetrovogo Khoz. 3.

Ja-45, 1971.
Identifiers: Fertilization, *Nitrogen, *Phosphorus, Ponds, *Sturgeon juveniles, *Volga delta (USSR).

The optimal ratio of N and P in fertilized fish breeding ponds in the Volga delta was studied dur-ing the raising of sturgeon juveniles. The hydrochemical and hydrobiological regimes as well as the chemical composition of the soils in the ponds were tested regularly. The optimal propor-tion of N and P in mixed mineral fertilizer for the tion of N and F in mixed mineral fertilizer for the first cycle of raising the juveniles was 6:1. The highest indices of fish productivity, growth of juveniles, intensity of feeding, development of a food base and a hydrochemical regime were ob-tained.—Copyright 1972, Biological Abstracts, Inc. W73-02681 OXYGEN CONSUMPTION OF LARVAE AND OXYGEN CONSUMPTION OF LARVAE AND JUVENILES OF THE CARP FAMILY IN RELA-TION TO THEIR ECOLOGY, (IN RUSSIAN), G. I. Karpeako, and E. S. Proskurina.
Tr Molodykh Uch Vaes Nauchno-Isaled Inst Morak Rybn Khoz Okeanogr. 4. p 7-13. 1970. En-

glish summary. Identifiers: *Carp, Ecology, Juveniles, Larvae, *Oxygen consumption (Fish), Rudd, Shemaya lar-vae, Azov roach, USSR.

The intensity of O2 consumption by larvae of vimba, shemaya, Azov roach and rudd differed. Shemaya larvae were the most oxyphilic, using 1.06-1.95 mg O2/g hourly. Azov roach and vimba of similar weights used 0.65-0.92 mg, and rudd used 0.57 mg. The relative O2 consumption decreased as the larvae grew. However the intensity of respiration increased during conversion to active feeding in vimba and during fin development in shemaya. The O2 consumption of juveniles of these species was about the same: at a weight of 9.5-1.5.9 mg, 0.46-0.89 mg/hr of O2/g were used. In shemaya a small increase in water temperature substantially increased the O2 consumption. Even a substantial increase in water temperature did not affect this index in rudd.-Copyright 1972, Biological Abstracts, Inc. W73-02682

SOME DATA ON THE RESPIRATION OF SAL-MON JUVENILES IN RELATION TO THE BIOTECHNIQUE OF BREEDING, (IN RUS-

SiAN),
A.E. Tamarin, and N. P. Komarova.
Tr Molodykh Uch Vses Nauchno-Issled Inst
Morsk Rybn Khoz Okeanogr. 4, p 14-21, 1970. English summary. Identifiers: Breeding (Fish), Juveniles, *Respira-tion (Fish), *Salmon juveniles.

In the larval and fingerling period metabolic intensity varied and was characterized by a curve with a single maximum at the time of full conversion to gill respiration. The O2 threshold reached its maximum value at this stage. The minimum index of metabolic intensity and threshold content of O2 in metabolic intensity and threshold content of $\Omega 2$ in the water was characteristic of salmon over 1 yr in age. The 'O2 zone of adaptation' could not be established for early juveniles and larvae. For yearlings metabolism did not depend on the partial $\Omega 2$ pressure at concentrations over 6 ml/l of water.—Copyright 1972, Biological Abstracts, Inc. W73-02683

FEEDING RHYTHM OF STURGEON IN THE VOLGOGRAD RESERVOIR, (IN RUSSIAN).

Tr Tsentr Nauchno-Issled Inst Osetrovogo Khoz.

17 i sentr Naucunno-issaed inst Oscirovogo Knoz. 3, p 146-153. 1971. Identifiers: CaddisFlies, Chironomids, *Feeding habits (Fish), Reservoirs, *Sturgeon, USSR, *Vol-gograd Reservoir (USSR).

The diurnal rhythm and food rations of sterlet in the upper zone of the Volgograd Reservoir were studied in May, June, Aug. and Sept. of 1966 and in May 1967. The intensity of feeding varied over a 24 hr period. Two increases in the intensity of feeding were observed, during the day and during he night. In the spring and the first half of the summer up to the end of Aug. 1966 the rations for a 24 hr period were low. 0.7% for a 186 g fish in May, 0.7% of a 234 g fish in June and 0.8% for a 250 g fish in the beginning of Aug. This was due to insufficient amounts of edible benthos in the first half of summer in the upper zone. The ration became sufficiently high-1.7% for a 195 g fish, only at the end of Aug., when the biomass of chironomids was substantially increased. The 24 hr ration increased by autumn. This was evidently hr ration increased by autumn. This was evidently due to the massive development of caddisfly larvae which was the basic food of the sterlet. The rational the state of the sterlet of the state of the sterlet. vac which was the basic tood of the steriet. The ra-tions of sterlet of various sizes were very great in May of 1967 compared to 1966. Massive develop-ment of chironomid larvae was observed in 1967

Field 08-ENGINEERING WORKS

Group 81-Fisheries Engineering

due to the warm and early spring.—Copyright 1972, Biological Abstracts, Inc. W73-02685

THE BREEDING AND RAISING OF THE PIKE PERCH IN PONDS,

I Thisses J. Imssen. Nat Belg. Vol 52, No 1, p 39-41. 1971. Illus. Identifiers: "Belgium, Breeding (Fish), Lucioper-ca lucioperca, Perch, "Pike perch, Ponds, Rutilus rutilus, "Rudd.

Lucioperca lucioperca (Percidae), a fresh-water fish from central and eastern Europe was imported and is successfully being raised in ponds. Fifteen grown specimens were transferred to the Vossem fishing lake in 1964 (Parc de Tervueren), which prior to this importation abounded with a variety of fish species with the rudd Rutilus rutilus predominating. An ichthyological inventory in 1969 disclosed a sharp drop of the dominant rudd population and an increase of the pike perches... Copyright 1972, Biological Abstracts, Inc. W73-02700

THE YELLOW PERCH FISHERIES OF DEER CREEK RESERVOIR, UTAH, WITH NOTES ON PARASITISM BY LIGULA INTESTINALIS.

Brigham Young Univ., Provo, Utah. G. R. Lewellen, and D. A. White.

Great Basin Nat. Vol 31, No 3, p 169-176. 1971. Identifiers: Algae, Bass, Cannibalism, Census, Copepods, Creel, *Deer Creek Reservoir (Utah), Fisheries, *Ligula intestinalis, *Parasitism, Perch, Plankton, Reservoirs, *Utah, *Yellow perch,

A creel census in 1968 showed 13.2% of fishermen utilized yellow perch for sport and food. Average hourly catch was good, but small size reflected a poor-quality fishery. Food of the youngest fishes was entirely zooplankton, with the addition of algae, then fish, and finally invertebrates as they aged, but zooplankton always remained the major source of food. Cannibalism was common among the older fishes. Body measurements had wide variation, indicating a stunted population. In best condition were 2-yr-old fish (K ± 2.20). There were 14.5% infected with tapeworm larvae, but mature fish were less parasitized than in 1955, and they were larger in size. Predation by largemouth bass and less feeding of perch on copepods may utilized yellow perch for sport and food. Average bass and less feeding of perch on copepods may explain this.--Copyright 1972, Biological Abstracts, Inc. W73-02701

EXPLOITATION OF CRAYFISH BY LAR-GEMOUTH BASS IN A SMALL OHIO POND, Ohio Cooperative Wildlife Research Unit, Colum-

S. H. Taub

S. H. 1aub. Prog Fish-Cult. Vol 34, No 1, p 55-58. 1972. Identifiers: Bass, Cambarus diogenes, *Crayfish, Exploitation, *Largemouth bass, Micropterus sal-moides, *Ohio, Ponds.

Largemouth bass, Micropterus salmoides, were stocked in a 1 ha unfished pond in Oct. 1967. No fish were in this pond prior to stocking; however, a large population of burrowing crayfish, Cambarus diogenes, existed. The purpose of this study was to determine growth rates of bass using mainly crayfish population. A population estimate of crayfish in Oct. 1967, revealed 37,000/ha. In less after the largemouth bass introduction, not enough crayfish could be captured to make further population estimates. Bass increased in mean total length from 70 mm at time of stocking to 206 mm in Oct. 1968, and to 259 mm in Oct. 1969. Analyses of bass stomach contents revealed intensive utilization in crayfish in 1968 and moderate use in 1969. This study demonstrates that in the absence of other prey fish, largemouth bass will intensively exploit a burrowing crayfish population in a small pond.--Copyright 1972, Biological Abstracts, Inc. W73-02704

IODINE CONTENT IN THE WATER AND SOIL OF FERTILIZED CARP PONDS, (IN RUSSIAN), V. F. Ushakova.

Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 152-161. 1970. English Identifiers: *Carp, Fertilized ponds, *Iodine, Ponds, Soil.

The I content was determined in the soil and water ane I content was oetermined in the soil and water of domestic carp rearing ponds which had been treated with organic mineral fertilizer for prolonged period. The ponds were not sufficiently supplied with I. Application of fertilizer temporarily increased the I content in the soil and water.—Copyright 1972, Biological Abstracts, Inc. W73-02711.

HERBIVOROUS FISH IN PONDS FOR PEAT

PRODUCTION, (IN RUSSIAN),
A. G. Mints, and E. N. Efimova.
Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst
Prudovogo Rybn Khoz. 5. p 20-29. 1970. English

summary.
Identifiers: Bighead, *Carp, Fish, *Herbivorous fish, *Peat production, Ponds.

Results of raising fish from a far eastern complex Results of raising rish from a far eastern complex in polyculture with carp in 'peaty' ponds are analyzed. The highest productivity of 17.6-20.7 centner/ha was obtained by stocking yearling carp (3500-3600 specimen/ha), grass carp (1000-1100 specimen/ha) and bighead (320-330 specimen/ha).-Copyright 1972, Biological Abstracts, Inc. W73-02718

HYDROCHEMICAL REGIME OF PONDS FER-TILIZED WITH COMPLEX CONCENTRATED FORMS OF FERTILIZER.

M. M. Mamaev. Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 132-151. 1970. English

summary.
Identifiers: *Fertilizers, Fish, *Hydrochemical regime, Ponds, *Fish rearing.

The effect of complex and concentrated forms of fertilizer including an N P K fertilizer, urea and ammonium carbonate on the hydrochemical regime of fish rearing ponds was studied. The O2 regime, content of biogenic elements, pH, and acidity were similar for all the fertilized ponds during the entire vegetative period. Fertilizer had a short-term effect on the dynamics of N and P. Es-sentially the biogenic regime depended on the con-stant processes between the water and soil. Fish productivity in the fertilized ponds was higher than in the control. The best indices were obtained by fertilization with urea .-- Copyright 1972, Biological Abstracts, Inc. W73-02728

FERTILIZER AND METHODS OF PREPARING THE SOIL IN CARP BREEDING PONDS. (IN

A. I. Batenko

Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 88-95. 1970. English summary.
Identifiers: *Breeding, *Carp ponds, *Fertilizers,

The use of pure mineral complexes (N and P) for fertilization of ponds did not give persistent results in fish productivity. Increasing the dose of N to 30 centners ha of ammonium nitrate increased fish productivity but not in proportion to the outlay of fertilizer. Simultaneous use of mineral and organic fertilizers-manure with phosphorite meal and subsequent cultivation gave the best results. Out of the mineral N fertilizers ammonia water provided good results.—Copyright 1972, Biological Ab-W73-02749

NITROGEN COMPOUND REGIME IN THE WATER AND SOIL OF PONDS, (IN RUSSIAN), A. I. Batenko, and T. A. Muratova. Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 96-114. 1970. English

summary.
Identifiers: *Fishery management, *Nitrogen compounds, Ponds, Soils.

The regime of different forms of N in the water and soil of breeding ponds was studied for 4 yr. Distribution of all forms of N with time depended more on seasonal conditions of the year than on the fertilizer. Even chemically or biologically active fertilizers such as ammonia water and manure did not change the seasonal nature of the N distribution. Application in large doses (630 kg/ha of N) did not change the seasonal distribution; only the concentration of N in the water was changed temporarily.—Copyright 1972, Biological Abstracts, Inc. W73-02756

AGE AND GROWTH OF PIKE IN FIVE IRISH LIMESTONE LAKES, University Coll., Dublin (Ireland). Dept. of Zoolo-

J. J. Bracken, and W. S. T. Champ. Sci Proc R Dublin Soc Ser B. Vol 3, No 1, p 1-33. 1971. Illus. Identifiers: Age (Fish), *Growth (Fish), *Ireland,

Lakes, *Limestone lakes, *Pike, Scale.

A total of 244 pike scales were examined from Lough Mask, 1509 from Lough Arrow, 3244 from Lough Ennell, 973 from Lough Sheelin and 1823 from Lough Derravaragh. It was found that the isometric length measurement taken from the posterior region of the scale could be used directly for back-calculation. The gill net data showed that the earlier 5 inch mesh size was too large and that in the main 3 yr olds and over were taken to the exchange of the contraction of the contraction. clusion of the younger pike. Mesh experiments, in Loughs Sheelin and Ennell showed that the 2.5 nch and 3.0 inch mesh sizes are the more suitable for taking younger fish. The maximum, minimum and modal values were examined for year classes in each lake and length distributions calculated. All data were recorded on computer cards and used to calculate growth curves, corrected growth curves, ultimate lengths, incremental growth rates, means, variances, standard deviations and standard error of the means and kurtosis values. Suitable sample sizes for each lake were calculated. Three categories sizes for each lake were calculated. Three catego-ries of growth were determined as follows: fast growth (Western lakes); average growth (Midland lakes); and slow growth (small lakes regardless of location). It was also deduced that the chaining, as described by Williams (1960), was present on the pike scales. It was also possible by scale reading to show when growth commenced and ended in ce-tain lakes. The back-calculations and L1 distribu-tions of male and feature that we have the contractions of tions of males and females showed that there was tions of mases and remains showed that there was no sexual difference, in length, during the first yr growth. From then on, however, the females were always bigger in Loughs Mass and Arrow. This tendency was not so marked in the other 3 lakes.—Copyright 1972, Biological Abstracts, Inc. W73-02883.

DAILY RATIONS AND NUTRITIVE COEFFI-CIENTS OF CARP LARVAE FED ON BRACHIONUS CALYCIFLORUS (PALLAS), (IN RUSSIAN),

Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 187-194. 1970. English

Identifiers: * vac, Larvac

Experimental 36.7% of dry (2.22) for dom fed on B. c concentration stracts, Inc. W73-02886

EFFECTIVE IN FOOD M IN RUSSIAN S. P. Tryamki Prudovogo R Identifiers: * bow trout, Pr

The effective diets for rais prepared from somewhat be Biological Ab W73-02896

FEEDING A IN RUSSIAN L. G. Motenk Sh Nauchno-Prudovogo R Identifiers: bivorous fish

The effect of growth and d exclusively : changed to la to Soin) the s ciently large of zooplankt right 1972, Bi W73-02898

RAISING SA OF JAPAN, (V. P. Mikhee and N. A. Sar Sb Nauchno-Prudovogo R mmary. Identifiers: In on raising,

The raising o sockeye, mas under artific juveniles and tion of ponds right 1972, Bi W73-02899

ESTIMATES MORTALIT HATCHERY YIELD, National Mar tle, Wash. Bi K. A. Henry. Res Rep Fish lus. Map.

ENGINEERING WORKS—Field 08

Fisheries Engineering-Group 81

Identifiers: *Brachionus calyciflorus, *Carp larvac, Larvac, Nutritive coefficients, Rations

Experimental data on the rations, which averaged 36.7% of dry weight, and the nutritive coefficients (2.22) for domestic carp larvae weighing up to 5 mg Values were included for temperatures and food concentration.—Copyright 1972, Biological Abstracts, Inc. W73-02886

EFFECTIVENESS OF THE USE OF NUTRIENTS IN FOOD MIXTURES BY RAINBOW TROUT, (IN RUSSIAN),

S. P. Tryamkina

Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 221-235. 1970. English

Identifiers: *Foods, Mixtures, *Nutrients, *Rainw trout. Protein

The effectiveness of the use of basic nutrients in 2 diets for rainbow trout were studied. The diet prepared from dry components was as good as the usual one on all the indices studied and was somewhat better for protein.—Copyright 1972, Biological Abstracts, Inc. W73-02896

FEEDING AND GROWTH OF HERBIVOROUS FISH LARVAE RAISED IN PONDS FOR FRY,

L. G. Motenkova. Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 176-186, 1970. English

Identifiers: Fish, Fry, *Growth (Fish), *Her-bivorous fish larvae, Plankton, Ponds, Zooplank-

The effect of the concentration of food on the diet, growth and development of larvae was studied. In the early period of raising, the larvae consumed exclusively small forms of zooplankton, then hanged to larger forms. In the IV stage (according to Soin) the spectrum of larval food became sufficiently large and they consumed almost all forms of zooplankton, including predatory ones.—Copyingh 1972, Biological Abstracts, Inc. W73-02898

RAISING SALMON IN THE INLAND WATERS

OF JAPAN, (IN RUSSIAN), V.P. Mikheev, A. N. Kanid'ev, L. V. Petrenko, and N. A. Sanin.

Sb Nauchno-Issled Rab Vses Nauchno-Issled Inst Prudovogo Rybn Khoz. 5. p 55-79. 1970. English

Identifiers: Inland waters, *Japan, Kokanee, *Salon raising, *Trout.

The raising of rainbow trout, kokanee, migratory sockeye, masu, chinook salmon and other salmon under artificial conditions in Japan was studied. The biotechnical methods, conditions of rearing juveniles and commercial fish, and the construction of ponds and nurseries are described.-Copyright 1972, Biological Abstracts, Inc. W73-02899

ESTIMATES OF MATURATION AND OCEAN MORTALITY FOR COLUMBIA RIVER HATCHERY FALL CHINOOK SALMON AND EFFECT OF NO OCEAN FISHING ON

YIELD, National Marine Fisheries Service, Service, Seattle, Wash. Biological Lab.

K. A. Henry. Res Rep Fish Comm Oreg. Vol 3, p 13-27. 1971. Illus. Map

Identifiers: *Chinook salmon, *Columbia River, Fall, Fish hatchery, *Maturation (Salmon), Mortality, Ocean, Oncorhynchus tshawytscha, Salmon, Yield.

Nearly 31 million fall chinook salmon, Oncor-hynchus tshawytscha (Walbaum, were marked and released in 1962-65 from 12 Columbia River and released in 1962-05 from 12 Columbia River hatcheries. All the major fisheries that caught these fish were systematically sampled in 1964-69. The estimated fishing intensities and maturity schedules for the 1962-brood releases were calculated and wherever possible comparisons made with the 1961 brood data. A general model that was developed for the 1961 brood data, and which ates ocean catch and river entry with recruitment, mortality, and maturation rates, was utilized. The calculated 6-mo. fishing intensity rates were higher for 1962 than 1961 brood for both were higher for 1962 than 1961 orders for boar general marks and Kalama Hatchery marks. Since it was not possible to make estimates for the 1962 brood Spring Creek fish, no direct comparisons for the 2 broods from this hatchery were attempted. Estimates of fishing mortality and proportions maturing changed relatively little when large changes in natural mortality were used. Ap-parently only about 0.3% of all marked fish released were alive at the beginning of their third yr, when most of them became available to the fisheries. Mortality rates for marked Kalama fish were used for unmarked Kalama Hatchery fish, but maturation rates were adjusted for possible delayed maturity of marked fish. The total catch of 1962-brood chinook from the Kalama Hatchery was estimated to be 134,409 kg, compared to 203,331 kg for the 1971 brood. Elimination of the estimated loss due to marking would have raised the 1962 catch to 153,045 kg. Ocean fishing apthe 1962 catch to 153,045 kg. Ocean fishing apparently reduced the number of Kalama fish that returned to the Columbia River by about 70% and the weight yield of hatchery fish by 25%. This compares with a reduction of about one-half in number and 19% in weight for 1961-brood Kalama Hatchery fish.—Copyright 1972, Biological Abstracts, Inc.

CULTURE OF THE YELLOW PERCH IN THE

LABORATORY, National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05G. W73-02952

SUCCESSFUL SPAWNING OF LARGEMOUTH BASS, MICORPTERUS SALMOIDES (LACEPEDE) UNDER LABORATORY CONDI-

National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05G. W73-02953

FISH OF THE KUIBYSHEV RESERVOIR (IN

RUSSIAN), E. P. Teyplakov, L. M. Khuzeeva, K. I. Vasyanin, A. A. Shchukina, and A. V. Lukin. Tr Tatar Otd Nauchno-Issled Inst Ozern Rechn

Rybn Khoz. 11. p 51-108. 1970 (71). Identifiers: Bleak, Bream, Catfish, *Diets (Fish), Dreissena, Fish, *Kuibyshev Reservoir (USSR), Perch, Pike, Reservoirs, Roach, USSR, *Mussels.

The size, age and sexual composition of catche were analyzed. Catches of bream which was the basic commercial fish increased from 3188 centners in 1959 to 24,115 centners in 1964, catch pike perch increased from 162 centners in 1959 to 3735 centners in 1963. The catches of catfish also increased, reaching 1847 centners in 1965. catch of pike decreased from 1960 to 1965. The smaller portions of the catches were mainly white bream and roach, which increased from 4520 cent-ners in 1957 to 23,882 centners in 1965. The general catch of all species in 1964 was 52,776 centners. Data on the nutrition of some fish were included.

Pike perch fed mainly on perch, striped perch, bleak; catfish fed on roach, perch, Volga pike perch, striped perch and bleak; 13% were valuable fish. The main food of white bream and roach was the zebra mussel (Dreissena) which was pientiful. The catches of valuable fish increased because these species were shifted to greater depths. Bream and pike perch spawned at a depth of 3-8 m in open waters. Pike adapted poorly. Tyulka was observed in the reservoir in 1966, which fed on pike perch.—Copyright 1972, Biological Abstracts, Inc. W73-03083

NATURAL REPODUCTION OF FISH IN THE VOLGOGRAD RESERVOIR (IN RUSSIAN).

ar Surat Utd Gos Nauchno-Issled Inst Rechn Ozern Rybn Khoz. 10: p 107-128, 1971. Identifiers: Bream, Carp, Catfish, Fish, Perch, Pike, *Reproduction (Fish), Reservoirs, USSR, *Volgograd Reservoir, Aquatic plants, *Water level effects. Tr Sarat Otd Gos Nauchno-Issled Inst Rechn

Upper, middle and lower zones of the Volgograd reservoir were differentiated according to reservoir were differentiated according to hydrological properties. Natural reproduction was more efficient in the upper and middle zones. In the upper zone favorable factors decreased the unfavorable effects of others. The drop of water level of the reservoir in the spring caused yearly disturbances in spawning. In the middle zone intensive conversion of shores and the resulting weak development of water plants had a negative effect on fish reproduction. A decrease in the level by 1-1.5 m caused egg mortality, delays in spawning. The reservoir conditions were more favorable for Volga pike-perch, pike and perch than for lithophilic and the majority of phytophilic fish, with exceptions of bream, catfish and white fish, with exceptions of bream, catfish a bream. Among commercially valuable fish, wild carp and pike had very low spawning efficiency.— Copyright 1972, Biological Abstracts, Inc. W73-03102

DISTRIBUTION OF RED SPOT DISEASE IN WATERS USED FOR FISH BREEDING (IN RUS-SIAN),

For primary bibliographic entry see Field 05C. W73-03109

SOME BLOOD CHARACTERISTICS IN BLACK BAIKAL GRAYLING THYMALLUS ARTICUS BAICALENSIS DYB. WITH REFERENCE TO THE ESTIMATION OF THE GROWING CON-DITIONS (IN RUSSIAN), Irkutskii Gosudarstvennyi Universitet (USSR).

Dept. of Vertebrate Zoology.
L. N. Ryzhova, and P. Y. Tugarina.
Vopr Ikhtiol, Vol 11, No 5, p 900-909, 1971, Illus.
Identifiers: "Blood characteristics (Fish), Cottocomephorus grewingki, Daphnia, Epischura, "Graylings, Rotifers, Shrimp, Thymallus articus baicalensis, USSR.

Graylings were fed with different types of food for Graylings were fed with different types of food for 4 yr while temperature and O2 conditions were constant. On the basis of hematological data it is recommended that during the growth of grayling their diet should consist of: rotifers, Epischura, few species of Daphnia (up to the certain fish age), Oligochaeta, freshwater shrimps, and the larva of builhead Cottocomephorus grewingki.—Copyright 1972, Biological Abstracts, Inc.

NUMBER OF COMMERCIAL FISH IN THE VOLGOGRAD RESERVOIR AND MEASURES FOR INCREASING THEIR PRODUCTIVITY,

(IN RUSSIAN), T. K. Nebol'sina, N. S. Elizarova, O. V. Roenko,

and L. P. Abramova. Tr Sarat Otd Gos Nauchno-Issled Inst Rechn Ozern Rybn Khoz. 10 p 129-175. 1971.

Field 08-ENGINEERING WORKS

Group 81—Fisheries Engineering

Identifiers: Brean, Commercial fish, Measure-ment, Perch, Pike, *Productivity (Fish), Reser-voirs, USSR, *Volgograd Reservoir, *Water level

The population of the basic commercial fishes in the Volgograd Reservoir reached a maximum in 1956 which was a 9 fold increase over the base year 1959. The general catch for 1968 equalled 28,273 centners. The reporductive efficiency of the majority of species remained at a low level as a result of constant unfavorable variation in the result of constant unfavorable variation in the water level. Some species such as bream and pike perch which adapted to spawning at great depths in the open part of the reservoir preserved their numbers at a relatively high level. After construction of the Saratov Hydroelectric Power Station in 1968-69 the reproductive conditions sharply deteriorated, in particular in the upper portion of the reservoir. The size and age composition of the fish population in sections of the reservoir sna the age of sexual maturation were studied. To increase fish reproduction in the middle and lower portions of the reservoir shallow-water artificial spawning grounds like those used in Dniepr River reservoirs are proposed.—Copyright 1972, Biological Abstracts, Inc.

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ANNUAL REPORT FY 1972. North Carolina Water Resources Research Inst.,

Available from the National Technical Informa-tion Service as PB-213 450, \$3.00 in paper copy, \$0.95 in microfiche. Report (1972) 66 p, 27 fig. OWRR A-999-NC (33), 14-31-0001-3533.

Descriptors: *Water Resources Institute, Educa-tion, *North Carolina, Projects, Research facili-

The Water Resources Research Institute is The University of North Carolina's water research center. Located at N.C. State University at center. Located at N.C. State University as Raleigh, the Institute serves all sixteen campuses of The University of North Carolina System. It works closely with the Department of Natural and Economic Resources (NCDNER) and other agencies in the formulation of a research program to State water resource problems. A responsive to State water resource prob 27-man Advisory Committee representative of State and federal water agencies, industry, conservation, agriculture, local government, and the general public provides program guidance and review. The Institute's research program for FY 1971-72 included 29 projects supported by an annual allotment and 13 matching grants from OWRR, USDI; a grant from the EPA; matching OWRR, USDI; a grant from the EPA; matching State appropriations; matching funds from Texas Gulf Sulphur Corp.; a grant from Z. Smith Reynolds Fdn.; and a grant from the Office of Water and Air Resources, NCDNER. All senior colleges and universities in North Carolina are eligible to participate in the Institute's program. During FY 1971-72, projects were conducted at N.C. State University, University of North Carolina at Chaple Hill, University of North Carolina at Charlotte, and Duke University. (Howells-North Carolina)

INVENTORY OF ACTIVE WAT RESOURCES RESEARCH PROJECTS NORTH CAROLINA. WATER North Carolina Water Resources Research Inst., Raleigh.

mary bibliographic entry see Field 09D.

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1972. Maine Univ., Bangor. Water Resources Center.

Available from the National Technical Informa-tion Service as PB-213 451, \$3.00 in paper copy, \$0.55 in microfiche. Annual Report No 8, July 1972. 19 p. OWRR A-999-ME (9).

Descriptors: "Water resources development, "Water quality control, "Projects, "Research and development, "Maine, "Water Resources In-stitute, Surface waters, Reviews, Water pollution sources, Project purposes, Ecology, Environmen-tal control, Abiotic environment, Eutrophication, Soil environment, Phosphates, Animal wastes (Wildlife), Microenvironment, DDT, Herbicides, Environmental effect. Identifiers: Research projects.

Water quality is the central theme of each element of the research projects supported by the Office of Water Resources Research (OWRR) in Maine during fiscal year 1972. The approach to water problems in Maine involves (1) a scientific problems in Maine involves (1) a scientific research program, (2) extensive cooperation with agencies and industries in order to contribute to and influence other water research and planning programs, and (3) an intensive public information program. Research progress is reported for progress concerning lake eutrophication, phosphate retention by lake sediments, animal waste effects on soil and water, DDT and marine microalgae, effects of burrowing tubificid worms, physicochemical parameters and colloidal filtration, dissolved pollution product gases in natural waters, political and environmental attitudes of voters, historic biochemical relationships in lakes, and effects of herbicides on algae. (Woodard-USGS) W73-02630

WATER RESEARCH AT THE UNIVERSITY OF

CONNECTICUT.
Connecticut Univ., Storrs. Inst. of Water

Available from the National Technical Informa-tion Service as PB-213 453, \$3.00 in paper copy, \$0.95 in microfiche. Report No 16, July 1972. 28 p. OWRR A-999-CONN (10).

Descriptors: *Water resources development, *Projects, *Research facilities, *Connecticut, Water demand, Reviews, Agriculture, Biology, Geology, Engineering, Water management (Applied), Legal aspects, Social aspects, Economics, Political aspects, *Water Resources Institute. Identifiers: *University of Connecticut, *Presearch projects* *Research projects.

The Institute of Water Resources at The University of Connecticut has as its prime objective the en-couragement, conduct, and coordination of research into the many aspects of water. Since its establishment in 1964, the institute has been a focal point for research activities oriented to the focal point for research activities oriented to the myriad water resources problems of Connecticut. At the same time, investigations have been sponsored which have contributed significantly to basic knowledge in water science. The institute has administered 50 projects, of which 29 currently are active. In addition to the traditional water research disciplines of agriculture, biology, engineering, and geology, studies have been carried out in the legal, sociologic, economic, and political aspects of water resources use and management. Some of legal, sociologic, economic, and pointeal aspects of water resources use and management. Some of the investigations have been multidisciplinary or interdisciplinary, providing a mechanism for more effective and innovative research. (Woodard-USGS) W73-02631

A SIX-YEAR REVIEW. New Hampshire Univ., Durham. Water Resources Research Center. Report, December 1971. 16 p. 9 photo, 1 tab. OWRR A-000-NH (4).

Descriptors: "Water resources, "Research and development, "Projects, "Reviews, "New Hampshire, Water quality, Water demand, Water yield, Legal aspects, Social aspects, Economics, Data collections, Publications, "Water Resources Legalityte. Identifiers: *University of New Hampshire.

An overview is presented of the research and training efforts that the Water Resource Research Center at the University of New Hampshire has undertaken from 1964 to 1971. The goals of the Center are to stimulate, facilitate, and coordinate research that will solve problems of water quality and quantity in New Hampshire, and provide for the training of solventiate. the training of scientists in water resources. Research efforts of the Center can be classified into four major categories: (1) chemical; (2) biological; (3) geological and hydrological; and (4) economic, legal and social aspects of water supplies and quality. A brief summary of the various projects, the investigators, and the publication resulting from the research is provided. (Woodard-1866s) USGS) W73-02655

9D. Grants, Contracts, and Research Act Allotments

ANNUAL REPORT FY 1972. North Carolina Water Resources Research Inst., For primary bibliographic entry see Field 09A. W73-02628

INVENTORY ACTIVE OF WATER RESEARCH PROJECTS NORTH CAROLINA. North Carolina Water Resources Research Inst.,

Available from the National Technical Informa-tion Service as PB-213 462, \$3.00 in paper copy, \$0.95 in microfiche. Report No 4 (revised) UNC-WRRI-72-04, July 1, 1972. 114 p. OWRR A-999-

Descriptors: *North Carolina, *Projects, Research and Development, Water resources, Federal government, State governments, Universities. Identifiers: *Research projects.

All water-related studies and research currently underway in North Carolina are summarized. Projects conducted by federal and state agencies, private industry, and all of the State's senior colleges and universities are included. Summaries include organization, investigator (for universities), descriptions, and beginning and anticipated completion dates. This inventory is revised on an annual basis. (Howells-North Carolina)

ANNUAL REPORT OF ACTIVITIES DURING FISCAL YEAR 1972.

Maine Univ., Bangor. Water Resources Center.

For primary bibliographic entry see Field 09A.

TECHNOLOGY TRANSFER IN WATER RESEARCH--THE INTERFACE BETWEEN PRODUCERS AND USERS. Nebraska Univ., Lincoln. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.

THE IMPO RESEARCH Bureau of Re For primary W73-02878

10. SCIE TECH

10A. Acq AND I

TECHNOLO RESEARCH PRODUCER Nebraska Research Ins For primary W73-02877

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10C. Sec AND I

BIBLIOGR/ AND MONI Mound Lab. For primary W73-02708

TRITIUM SURVEY. Battelle Me bus Labs. For primary W73-02720

ECOLOGIC RADIONUC TION. A SE Washington For primary W73-02746

10F. Pre

BIOLOGIC LUTION, I Oak Ridge ! W73-02766

LITERATU Rutgers - Th W73-02934

DETECTIO REVIEW O Gulf Coast For primary THE IMPORTANCE OF A PRACTICAL RESEARCH INPUT TO WATER RESOURCES DEVELOPMENT,
Bureau of Reclamation, Denver, Colo. For primary bibliographic entry see Field 06B. W73-02878

W73-03174

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition AND Processing

TECHNOLOGY TRANSFER IN WATER
RESEARCH-THE INTERFACE BETWEEN
PRODUCERS AND USERS.
Nebraska Univ., Lincoln. Water
Research Inst.
For primary bibliographic entry see Field 06B.
W73-02877

THE TRANSFER OF WATER RESEARCH OUT-PUT BY THE ENVIRONMENTAL PROTEC-TION AGENCY, Environmental Protection Agency, Washington, D.C. For primary bibliographic entry see Field 06B. W73-02879

10C. Secondary Publication AND Distribution

BIBLIOGRAPHY ON HANDLING, CONTROL AND MONITORING OF TRITIUM (DEC. 1968-JAN. 1972), Mound Lab., Miamisburg, Ohio. For primary bibliographic entry see Field 05B. W73-02708

TRITIUM AND ITS EFFECTS IN THE EN-VIRONMENT - A SELECTED LITERATURE SURVEY. Battelle Memorial Inst., Columbus, Ohio. Columbus Labs. For primary bibliographic entry see Field 05C. W73-02720

ECOLOGICAL TECHNIQUES UTILIZING RADIONUCLIDES AND IONIZING RADIA-TION. A SELECTED BIBLIOGRAPHY, Washington State Univ., Pullman. Dept. of Zoology. For primary bibliographic entry see Field 05B. W73-02746

10F. Preparation of Reviews

BIOLOGICAL ASPECTS OF THERMAL POL-LUTION, II. SCIENTIFIC BASIS FOR WATER TEMPERATURE STANDARDS AT POWER PLANTS, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 05C.

LITERATURE REVIEW: ECONOMICS, Rutgers - The State Univ., New Brunswick, N.J. For primary bibliographic entry see Field 05G. W73-02934

DETECTION OF VIRUSES IN WATER: A REVIEW OF METHODS AND APPLICATION, Gulf Coast Water Hygiene Lab., Dauphin Island, Ala. For primary bibliographic entry see Field 05A. SCIENTIFIC AND TECHNICAL INFORMATION—Field 10

2-4-5-T Morpholog Varieties 1 W73-03080

The Influ Respiratio lus (O.F. h W73-03166

ABLATION Some Fearyye zali Shanya). W73-02633

Mass Bud Northern (Byudzhet Terskey A kak), W73-02634

Ablation of nika Seme W73-02636

> Rate of M Some Gl (Skorostne torykh led W73-0263

ABRAMIS B Growth Abundanc Water Pas of the Nys W73-02676

Sodium E: by the Mo W73-03073

Salt Injury Cations Vo W73-0307

Effects of (Gossypiu Cell Micro W73-03081

Variations Roots of C W73-03085

The Influe Upon the Leaves, W73-03089

Evidence Selectivity W73-03113

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ABSTRACT: Tritium an Selected L W73-02720

An Integr Water and W73-03099

- 81

	ADM SWILLIAMON REPORTED	Print With mallers A.
2-4-5-T Morphological Response of Two Mesquite Varieties to 2,4,5-T and Picloram,	Vegetable Production Under Plastic on the Desert Seacoast of Abu Dhabi, W73-03110 3F	Mechanisms of Sludge Thickening, W73-02948 51
W73-03080 4A	ACCELERATED EROSION	Activated Sludge Processing, W73-02981 51
24D mothed annually wall beautiful.	Erosional Consequences of Timber Harvesting:	# 13-02561
The Influence of Herbicide 2,4-D-NA on Respiration and Survival of Simocephalus vetu-	An Appraisal, W73-02957 2J	ADDITIVES A Hydrophilic Polymer as a Soil Amendment,
lus (O.F. Muller) (Cladocera), W73-03166 5C	ACCELERATING FLOW	W73-03098 20
ABLATION	Accelerated Motion of a Sphere in an Oscillat- ing Fluid,	ADJUDICATION
Some Features of Tien Shan Glaciers (Nekoto- ryye zakonomernosti oledeneniya Tyan'-	W73-03028 8B	Adjudication Provisions Under the 1909 Water CodeSurvey of Case Law and Proposals for Legislative Amendment,
Shanya). W73-02633 2C	Moment Characteristics of Cascades Under Nonstationary Flow Conditions,	W73-02894 6
Mass Budget of the Kara-Batkak Glacier on the	W73-03029 8B	ADMINISTRATION A Comparison of Public and Resource Ad
Northern Slope of the Terskey Ala-Too Range (Byudzhet lednikov severnogo sklona khrebta	ACCELERATING FLOWS Experimental Investigation of Effects of Un-	ministrator Visual Perceptions of an Outdoo Water-Based Recreation Area,
Terskey Ala-Too na primere lednika Kara-Bat- kak),	steady Flows on a Submerged Cylinder, W73-03019 8B	W73-02612 6
W73-02634 2C	ACCESS ROUTES	North Carolina (Analysis of State's Water Po- lution Law and Comparison with Present as
Ablation of the Semenov Glacier (Tayaniye led-	Erosional Consequences of Timber Harvesting: An Appraisal,	Proposed Tennessee Law),
nika Semenova), W73-02636 2C	W73-02957 2J	W73-03218
Rate of Movement, Ablation, and Dynamics of Some Glaciers of the Ak-Shiyrak Range	ACID-BASE EQUILIBRIUM Acidity and Lactate Content in the Blood of	ADMINISTRATIVE AGENCIES EPA, Environmental Legislation and Energy,
(Skorostnoy rezhim, tayaniye i dinamika neko- torykh lednikov massiva Ak-Shiyrak),	Young Atlantic Salmon (Salmo salar L.) Exposed to High pCO2,	W73-02739
W73-02637 2C	W73-03170 5C	Missouri (Analysis of State Water Pollution Law and Comparison with Present and
ABRAMIS BRAMA Growth Characteristics, Structure and	ACID MINE WATER The Interaction of Sewage, Thermal, and Acid	Proposed Tennessee Law), W73-03217
Growth Characteristics, Structure and Abundance of Abramis Brama (L.) In the	Mine Water Loadings on the Growth of	Texas (Analysis of State Water Pollution La
Water Passages of the Summer Diked Marshes of the Nyamunus Delta (In Russian),	Chlorella, W73-02974 5C	and Comparison with Present and Propose Tennessee Law).
W73-02678 5C	Antibodies Against Human Enteric Bacteria in	W73-03219 6
ABSORPTION - Sodium Export From Bean Leaves as Affected	Brown Bullheads (Ictalurus Nebulosus, Leseuer) from Contaminated Waters,	ADRIA (MONFALCONE) - DANUBE BASIN The Adria (Monfalcone) - Danube Basin Inte
by the Mode of Application, W73-03073 21	W73-02975	national Waterway,
Salt Injury to Plants with Special Reference to	Neutralization of Ferrous Iron-Containing Acid Wastes,	W73-03230 4
Cations Versus Anions and Ion Activities, W73-03077 3C	W73-02993 5D	A New Approach for Water Reclamation
Effects of Salt Treatments of Cotton Plants	Limestone Neutralization of Dilute Acid Waste Waters,	Complete Treatment of Waste Water by Physico-Chemical Processes,
(Gossypium hirsutum L.) on Leaf Mesophyll Cell Microstructure,	W73-02994 5D	W73-02607
W73-03081 3C	Neutralization of Ferrous Iron-Containing Acid	ADVANCED WASTE TREATMENT
Variations in Sodium Uptake Along Primary	Wastes, W73-02995 5D	Capital and Operating Costs for Convention and Advanced Waste Treatment.
Roots of Corn Seedlings, W73-03085 3C	ACIDIC WATER	W73-02913
The Influence of Low Substrate Sodium Levels	The Use of Aquatic Plants in the Rehabilitation of Acid Polluted Streams,	AERATION Role of Vertical Shafts in the Movement
Upon the Free Amino Acid Content of Cotton	W73-02611 5G	Ground Water in Carbonate Aquifers, W73-02803
Leaves, W73-03089 3C	ACOUSTICS Hydrodynamic Forces Acting on Sonic Oscilla-	Aerating Apparatus,
Evidence for Hormonal Regulation of the	tors in Sonic Transmissions (Forces hydrodynamiques agissant sur les oscillateurs	W73-02984 5
Selectivity of Ion Uptake by Plant Cells, W73-03113	soniques prevus dans les transmissions soniques),	Sewage Treatment Apparatus, W73-02987
Patterns of Water Uptake and Root Distribu-	w73-03056 8B	Limestone Neutralization of Dilute Acid Was
tion of Soybeans (Glycine max.) in the Presence of a Water Table,	ACTINOMYCETES	Waters,
W73-03114 3F	Production of Geosmin and 2-Exo-Hydroxy-2- Methylbornane by Streptomyces odorifer,	W73-02994
ABSTRACTS	W73-02949 5A	Biogrid Unit and Method,
Tritium and Its Effects in the Environment - A Selected Literature Survey.	ACTIVATED SLUDGE	W73-03001
W73-02720 5C	Optimal Conditioning Procedures for Waste Activated Sludge Disposal,	Biochemical Sewage Treatment Via High Put ty Molecular Oxygen,
An Integrated System for Providing Power,	W73-02616 5D	W73-03004
Water and Food for Desert Coasts,	The Effect of pH on Aerobic Sludge Digestion,	Apparatus for Biologically Purifying Sewage, W73-03014

The D Stream Balan W73-0

Metho Sedim Acqui W73-0

An A Fisher W73-0

Detec Metho W73-0

Progre for C Volum W73-C

Conce tration ment of W73-0

Systemation C W73-0

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AERATION

Aeration of Weirs,	AIR POLLUTION EFFECTS	ALUMINUM
W73-03142 8B	Scrubbed Diesel Exhaust for Carbon Dioxide Enrichment of Greenhouse Vegetables,	Toxicity of Aluminum Hydroxide Complexes in
AERIAL PHOTOGRAPHY	W73-03074 3F	Neutral and Basic Media to Rainbow Trout, W73-02951 5C
Remote Sensing of Sea Ice from Earth Satel-		A6 6500 CTM
lites, W73-02645 7B	AIRCRAFT Fraunhofer Line-Depth Sensing Applied to	AMINO ACIDS The Influence of Low Substrate Sodium Levels
ESTELOGA	Water,	Upon the Free Amino Acid Content of Cotton
Remote Sensing of Environmental Pollution, W73-03131 5A	W73-03140 5A	Leaves,
W73-03131 5A	ALABAMA WOLLDWITZ WALTERS	W73-03089 3C
Remote Sensing of Water Pollution,	Pollution Hearing Sets a Southern Landmark.	AMMONIA
W73-03132 5A	W73-02960 5G	Salt Creek Two Stage Nitrification Plant,
Remote Sensing of Snow Fields from Earth	ALCOHOL MONOLAYERS	W73-02963 5D
Satellites, W73-03133 7B	An Expansion Cloud Chamber Study of Water	Changes in the Peripheral Blood in Carp
W/3-03133	Evaporation, W73-02890 2B	(Cyprinus Carpio L.) Under the Influence of
Nimbus 3 and 4 Observations of Snow Cover		Ammonium Liquor (Zmiany we Krwi Ob-
and Other Hydrological Features in the Western Himalayas,	ALFALFA Studies on the Physiological Nature of Alfalfa	wodowej Karpis (Cyprinus Carpio L.) Pod Wpływem Wody Amoniakalnesj,
W73-03134 7B	Plants: 9. Effect of soil Moisture on the	W73-03158 5C
Hudralasia Canditions Vienned by the Nierbox	Summer Growth of Alfalfa (In Japanese),	AMPHIBIANS
Hydrologic Conditions Viewed by the Nimbus Meteorological Satellites,	W73-03200 3F	Radionuclide Cycling in Natural Populations of
W73-03135 7B	ALGAE	Amphibians. Annual Progress Report, June 16,
A PROPER DISCRETION	Improving Water Quality by Removal of Pesti-	1971 - June 15, 1972,
AEROBIC DIGESTION The Effect of pH on Aerobic Sludge Digestion,	cide Pollutants with Aquatic Plants, W73-02621 5G	W73-02755 5C
W73-02897 5D	W73-02621 5G	AMPHIPODA
	Fine Structure of Swarmers of Cladophora and	Culture, Reproduction, and Temperature
AEROBIC TREATMENT Biogrid Unit and Method,	Chaetomorpha. III. Wall Synthesis and Development,	Tolerance of Pontoporeia affinis in the Labora-
W73-03001 5D	W73-02966 5C	tory, W73-03168 SC
District Company Control Via Wat Day		The same of the sa
Biochemical Sewage Treatment Via High Puri- ty Molecular Oxygen,	Effects of Streptomycin on the Ultrastructure of Plastids in Euglena,	ANAEROBIC BACTERIA
W73-03004 5D	W73-02972 5C	Nitrate Transformations in Surface Waters; I. A Study of Various Factors Affecting the Rates
A	The Interaction of Sewage, Thermal, and Acid	of Denitrification and Immobilization in Sur-
Apparatus for Biologically Purifying Sewage, W73-03014 5D	Mine Water Loadings on the Growth of	face Waters, and II. Characterization of the
The state of the s	Chlorella,	Surface Waters in the Wabash River and Three
AGE	W73-02974 5C	Farm Ponds, W73-03191 5B
Examples of the Internal Condtions of Some Old Earth Dams.	Surface Phytoplankton and Some Aspects of	W 13-03191
W73-02841 8A	the Physical-Chemical Limnology of Three	ANAEROBIC CONDITIONS
- CRICHERUS - L'OURS - CONTROL LO	Areas on Lake Texoma, W73-03072 2H	The Use of a Multi-Celled Apparatus for
AGRICULTURAL CHEMICALS Process of Purifying Water by Irradiating It,	W73-03072 2H	Anaerobic Studies of Flooded Root Systems, W73-03194 21
W73-02982 5D	ALGAL MATS	175-05154
AIR-EARTH INTERFACES	Ecology of Yellowstone Thermal Effluent Systems: Net Primary Production and Species	ANAEROBIC DIGESTION
A Method for the Determination of the Ther-	Diversity of a Successional Blue-Green Algal	Anaerobic Treatment of Starch Wastewaters, W73-02619 SD
mal Properties of Soil Near the Surface,	Mat,	W 73-02619
W73-03076 2G	W73-02980 5C	ANALYTICAL TECHNIQUES
AIR ENVIRONMENT	ALLUVIAL AQUIFERS	Identification of Toxic Components in Oil
Annual Report of the Eastern Environmental	Shallow Aquifers Relative to Surface Waters,	Refinery Effluents and Determination of Their Effect Upon the Aquatic Biota,
Radiation Laboratory, January-December 1970.	North Platte River Valley, Goshen County,	W73-02609 5A
W73-02744 5B	Wyoming, W73-02900 4B	Appeal Person of the Person Project
AIR POLLUTION	Of a street of the street of t	Annual Report of the Eastern Environmental Radiation Laboratory, January-December 1970.
EPA, Environmental Legislation and Energy,	ALLUVIAL CHANNELS Dispersion of Contaminated Bed-Load Parti-	W73-02744 5B
W73-02739 5G	cles.	The control of the co
Environmental Radioactivity Measurement Ex-	W73-02650 5B	Uranium Concentration in Recent Ocean Sedi- ments in Zones of Rising Currents,
perience Near a Fuels Reprocessing Plant,	ALPINE	W73-02748 5B
W73-02741 5B	Underground Mineral Water of Alpine Regions	make the same and a supply the same to
Electrical Energy Needs and Environmental	of Southeastern Kazakhstan (Podzemnyye	Evaluation of Ion-Exchange Surveillance Sam- pler for Analyzing Radioactive Liquid Ef-
Problems, Now and in the Future.	mineral'nyye vody vysokogornykh rayonov	fluents.
W73-02768 5C	Yugo-Vostochnogo Kazakhstana), W73-02818 4B	W73-02753 5A
Air Pollution from Combustion Products,		Cloud Chamber Design for Water Evaporation
W73-02771 5C,	ALTERATION OF FLOW Effects of an Artificial Stream on Marine Com-	Studies
Biological Effects of Air Pollution,	munities,	W73-02889 2B
W73-02773 5C	W73-03171	
Removing Oil or Oil Substance from Water and	ALUM	A System for the Rapid Analysis of Organic Phosphorus in Water Samples or Fractions
Land Areas Using Corncob Components,	Removal of Phosphates from Sewage Effluent,	from Chromoatographic Columns,
W73-02991 5G	W73-03000 5D	W73-02968 5A

	SUBJECT INDEX	
		ARTIFICIAL RECHARGE
The Determination of Primary Production in a	Spionidae (Polychaeta) from the Northeast	The Availability of Ground Water in New Cas-
Stream Using an Exact Solution to the Oxygen	Pacific Ocean,	the County, Delaware,
Balance Equation,	W73-03221 5B	W73-02785 4B
W73-02971 5C	ANTELOPE VALLEY	
Methods for the Characterization of Suspended	'Apollo County Park', Waste Water Reclama-	The Availability of Ground Water in Eastern Sussex County, Delaware,
Sediment and Selected Applications for the	tion Project for the Antelope Valley Area, Los	W73-02805 4R
Acquired Data,	Angeles County.	
W73-02977 5B	W73-02867 5D	The Availability of Ground Water in Kent
An Approach to the Problem of Pollution and	ANTIBODIES	County, Delaware, With Special Reference to the Dover Area,
Fisheries,	Antibodies Against Human Enteric Bacteria in	W73-02806 4B
W73-03163 5C	Brown Bullheads (Ictalurus Nebulosus,	and the second second second second second
Detection of Viruses in Water: A Review of	Leseuer) from Contaminated Waters, W73-02975 5C	Ground-Water Resources and Geology of Cook
Methods and Application,	#13-02513	County, Georgia, W73-02807 4B
W73-03174 5A	AQUATIC ENVIRONMENT	45
Progress in the Development of an Apparatus	Annual Report of the Eastern Environmental	ARCH DAMS
for Concentration of Viruses From Large	Radiation Laboratory, January-December 1970. W73-02744 5B	Comparison of Analytical and Structural
Volumes of Water,	W73-02744 5B	Behavior Results for Morrow Point Dam, W73-02847
W73-03175 5A	Trace-Metal Associations in Sub-Artic and Arc-	The Paris of the P
Concentration of Viruses by Osmotic Ultrafil-	tic Marine Environments - Progress Report,	ARCTIC OCEAN
tration: A Preliminary Report on the Develop-	June 1971-May 1972, W73-02754 5B	Trace-Metal Associations in Sub-Artic and Arc-
ment of a Model System,	H 13-02134	tic Marine Environments - Progress Report,
W73-03176 5A	AQUATIC HABITATS	June 1971-May 1972, W73-02754 5B
Systems Approach to Problems of Water Pollu-	Biological Aspects of Thermal Pollution, II.	35
tion Control,	Scientific Basis for Water Temperature Stan- dards at Power Plants,	ARID LANDS
W73-03222 5G	W73-02766 5C	Future Environments of Arid Regions of the
ANEMOMETERS	Afternoon of Company has been been been been been been been bee	Southwest. W73-03118 6B
Measurements of Turbulence in Water at High	AQUATIC INSECTS	W/3-03110
Velocity,	Some Ecological Notes on Lotic Dipteran Emergence in Prater's Creek, South Carolina.	Future Environments of Arid Lands of
W73-02790 2E	W73-03162 5C	Southwestern States,
ANESTHESIA	Lat. be all found to be an in the second by	W73-03119 6B
Effects of Locomoter Restraint and of	AQUATIC MICROORGANISMS	A Land-Use Plan for the Arid Southwest,
Anaesthesia with Urethane or MS-222 on the	Process for Removing Contaminants from Waste-Water,	W73-03120 6B
Reactions of Young Salmon (Salmo salahrL.) to Environmental Fluctuations of pH and Carbon	W73-03003 5D	The Potus Homes Occurrence of the Arid
Dioxide Tension,	100 Miles and Index January	The Future Human Occupance of the Arid Southwest,
W73-03169 5C	AQUATIC PLANTS The Use of Aquatic Plants in the Rehabilitation	W73-03121 6B
ANIMAL METABOLISM	of Acid Polluted Streams.	
The Influence of Thermal Acclimation on the	W73-02611 5G	Public Land Management in the Arid
Relation Between Oxygen Consumption and	The state of the land of the state of the st	Southwest, W73-03122 6B
Temperature in Littorina littorea (L.) and Myti-	Improving Water Quality by Removal of Pesti- cide Pollutants with Aquatic Plants,	
lus edulis L.,	W73-02621 5G	Arid Lands and Their Future,
W73-02760 5C	Mary and a supplementary of the Political Conference of th	W73-03123 6B
ANIMAL PHYSIOLOGY	A C-14 Assay for Photorespiration in Aquatic	Health Related Problems in Arid Lands.
Bioassays of Quality in Water Resources of	Plants, W73-02978 5C	W73-03126 5F
Major Importance to New Mexico, W73-02876 5C	Table 10 and administration of the engineering for	
W73-02876 5C	Surface Phytoplankton and Some Aspects of	Discussion of Waste Disposal in Arid Lands, W73-03129 SF
ANIMALS	the Physical-Chemical Limnology of Three Areas on Lake Texoma,	
Biological Effects of Air Pollution,	W73-03072 2H	AROCLORS
W73-02773 5C		Organochlorine Insecticide, Herbicide and
ANION EXCHANGE	AQUEOUS SALT SOLUTIONS Effect of Dissolved Salts on Water Solubility	Polychlorinated Biphenyl (PCB) Inhibition of Nakatpase in Rainbow Trout,
The Use of Quaternary Ammonium Resin-	of Lindane,	W73-03165 50
Triiodide Complex to Inactivate Virus and	W73-03185 5G	N SI ASSESSED.
Selected Bacteria, W73-03188 5F		ARTESIAN AQUIFERS
	AQUEOUS SOLUTIONS Determination of A Trace Amount of Cadmium	The Reciprocity Principle in Flow Through Heterogeneous Porous Media,
ANIONS Salt Injury to Plante with Special Reference to	in Water by Atomic Absorption Spec-	W73-02827 4E
Salt Injury to Plants with Special Reference to Cations Versus Anions and Ion Activities,	trophotometry Combined with Ammonium Pyr-	XV
W73-03077 3C	rolidine Dithiocarbamate-Methl Isobutyl	ARTIFICIAL RECHARGE Gravitational and Dispersive Mixing is
British In south from Table 2011	Ketone Extraction Using Large Aqueous	Gravitational and Dispersive Mixing in Aquifers,
ANISOTROPY The Tensor Character of the Dispersion Coeffi-	Phase/Solvent Rati os, W73-02939 5A	W73-02791 2F
cient in Anisotropic Porous Media,	FTW0 62.6	DX.
W73-02831 2G	AQUIFER CHARACTERISTICS	Monitoring Groundwater Reservoirs in Pied
ANNELIDS	Geology and Ground Water of the Pajaro Val- ley Area, Santa Cruz and Monterey Counties,	mont Plains of Tien Shan (Upravleniye rezhimom podzemnykh vod na predgornykh
Some Species of Phyllodocidae, Syllidae,	California,	ravninakh Tyan' -Shanya),
Nephtyidae, Goniadidae, Apistobranchidae and	W73-02653 4B	W73-02815 4B

The As Eleocha Meuse,' W73-026

The Bre Ponds, W73-027 BENEFIC Handlin W73-027 BENEFIT-Environ Nuclear W73-021 BENEFIT A Comp Develop Benefit W73-029 BENEFIT Water F W73-02

Integrate ty of Un W73-02

A Meth Irrigate in Sease W73-03

Benefit Quality W73-03 BIBLIOG Bibliog toring o W73-02

Tritium Selecte W73-02

Ecolog and Io raphy, W73-02

BIG AND Hydrol Soda L W73-03 BIG AND Bathyr Washo W73-03 BIG LOS Probab Contro Station W73-0 BILBER! um my W73-0 BILGE Toxici W73-0 BILGE V Charac

W73-0

ASA CREEK-KASKASKIA RIVER (ILL)

ASA CREEK-KASKASKIA RIVER (ILL) Physico-Chemical Limnology and Periphyton in a Warm-Water Stream Receiving Wastewater Treatment Plant Effluent,	Towards a Philosophy of Planning: An Investigation into Attitudes Held by Federal Water Resource Planners, W73-02955 6E	BASIC DATA COLLECTIONS Water Resources Data for Colorado, 1971: Part 1. Surface-Water Records. W73-02643 7C
W73-02603 SD	CHEST VALLEY SOUTHY	TARNES ACTES
SPHALT BARRIER	AUTOMATIC CONTROL The Coming Technical Revolution in Meter	Compilation of Water Quality Data and Parameters from Kansas Rivers and Streams,
Effect of an Asphalt Barrier on Water Redis-	Reading,	W73-02973
tribution after Infiltration in Sandy Soils, W73-03189	W73-02863 7B	BASINS
SCHOOL WAS AND	An Experiment in Computer-Assisted Super- visory Control of a Water Distribution System,	Development of Water Resources of a Basin Taking Economic Aspects into Account: Pecu-
SSAY Bibliography on Handling, Control and Moni-	W73-02871 4A	liarities of Investigation of Practical Irrigation Problems,
toring of Tritium (Dec. 1968-Jan. 1972), W73-02708 5B	AUTOMATIC METER READING	W73-03226
Budionativity of Waters in North sectors Bort of	The Coming Technical Revolution in Meter Reading,	Some Problems of the Optimal Use of a Basin
Radioactivity of Waters in Northeastern Part of Atlantic Ocean,	W73-02863 7B	Water Resources on the Basis of Mathematical Modelling,
W73-02710 5B	BACKGROUND RADIATION	W73-03227 4A
Contemporary Sources and Geochemistry of	West Valley Reprocessing Plant. Environmen-	Optimization of Basin Water Resources Utiliza-
Tritium in the Gulf of Mexico and its Distribu- tive Province,	tal Report No. 11, 2nd Half 1971, W73-02712 5B	tion, W73-03228 4A
W73-02730 5B	BACTERIA	
Aquatic Radiological Monitoring Browns Ferry	Microbial Modification of Ground Water,	Optimum Use of Water Resources of Basins in Irrigation,
Nuclear Plant,	W73-02602 5B	W73-03229 3F
-	The Occurrence and Possible Source of the	The Adria (Monfalcone) - Danube Basin Inter-
Uranium Concentration in Recent Ocean Sedi-	Coliform Bacteria on the Shoreline of Northern Lake Michigan,	national Waterway, W73-03230 4A
ments in Zones of Rising Currents, W73-02748 5B	W73-02606 5B	
MARINE.	Pollution by Coliform Bacteria in Sea Water of	Mercury Pollution of Golf Course Lakes,
Origin of Manganese Nodules of the Pacific Ocean From Radioisotope Data,	Swimming Resorts: II (In Japanese),	W73-02615 5B
W73-02752 5B	W73-02928 5B	Successful Spawning of Largemouth Bass,
TLANTIC OCEAN	Solubilization of inorganic phosphate by bac-	Micorpterus salmoides (Lacepede) Under Laboratory Conditions,
Radioactivity of Waters in Northeastern Part of	teria isolated from upper Klamath Lake sedi- ment,	W73-02953 5G
Atlantic Ocean, W73-02710 5B	W73-02954 5C	BATHYMETRY
AND REAL PROPERTY WHEN THE PROPERTY OF THE PARTY OF THE P	Activated Sludge Processing,	Bathymetric Reconnaissance of Big and Little
Contemporary Sources and Geochemistry of Tritium in the Gulf of Mexico and its Distribu-	W73-02981 5D	Washoe Lakes, Washoe County, Nevada, W73-03138 7C
tive Province, W73-02730 5B	Removal of Phosphates from Sewage Effluent,	BEACHES
The same of the party of the last of the l	W73-03000 5D	Non-Steady Flow on Sloping Beach with Large
Slumping on the Eastern Margin of the Rockall Bank, North Atlantic Ocean,	Method for Determining Number of Bacteria in	Roughness Elements, W73-03040 2E
W73-02799 2J	Ooze Deposits of Water Reservoirs (In Russian),	BEANS
TLANTIC SALMON	W73-03115 5A	Sodium Export From Bean Leaves as Affected
Effects of Locomoter Restraint and of	BACTERICIDES	by the Mode of Application, W73-03073
Anaesthesia with Urethane or MS-222 on the Reactions of Young Salmon (Salmo salahrL.) to	The Antibacterial Capabilities of	THE REST, COLUMN TO A PROPERTY OF THE PARTY
Environmental Fluctuations of pH and Carbon	Polyhalogenated Ion Exchange Resins, W73-03187 5F	Calcium and Salt Toleration by Bean Plants, W73-03094 3C
Dioxide Tension, W73-03169 5C	The Use of Quaternary Ammonium Resin-	BEAR RIVER BASIN
Acidity and Lactate Content in the Blood of	Triiodide Complex to Inactivate Virus and Selected Bacteria,	A Self-Verifying Hybrid Computer Model of River-Basin Hydrology,
Young Atlantic Salmon (Salmo salar L.) Ex-	W73-03188 5F	W73-03183 2A
posed to High pCO2, W73-03170	BALLAST	BED LOAD
Contract Name Parts Suppose and Print	Toxicity and Spreading of Oil in Sea Water,	Temperature Effects in High-Transport, Flat-
TOMIC ABSORPTION Identification of Toxic Components in Oil	W73-02903 5G	Bed Flows, W73-02789 2J
Refinery Effluents and Determination of Their Effect Upon the Aquatic Biota,	BARGES Hydrodynamic Forces on Diffuser Pipes Due	Bed-Load Transport in Mountain Streams,
W73-02609 5A	to Barge Passage,	W73-02893
TTITUDES	W73-03032	BEHAVIOR
Public Attitudes Toward Reuse of Reclaimed	BASE FLOW	Public Attitudes Toward Reuse of Reclaimed Water.
Water, W73-02601 5D	Groundwater Flow in Partially Saturated Soils,	W73-02601 , 5D
Marianna Grandensa Tearrenia in Net-	W73-02624 5B	BELGIUM
A Comparison of Public and Resource Administrator Visual Perceptions of an Outdoor	BASELINE STUDIES The Codorus Creek Wastewater Management Study, Summary Report and Conclusions.	Studies on the Productivity of the Ponds of Upper Belgium: The Biology of Limnephilus
Water-Based Recreation Area, W73-02612 6B	W73-02869 Summary Report and Conclusions.	lunatus Curtis (Trichoptera), W73-02689 21

The Association of Littorella Uniflora and Eleocharis Acicularis in the 'Entre-Sambre-Et-	BIOASSAY Identification of Toxic Components in Oil	BIOLOGICAL TREATMENT Activated Sludge Processing,
Meuse,' W73-02691 2I	Refinery Effluents and Determination of Their Effect Upon the Aquatic Biota,	W73-02981 5D
The Breeding and Raising of the Pike Perch in	W73-02609 5A	Aerating Apparatus, W73-02984 5D
Ponds,	Uranium Concentration in Recent Ocean Sedi-	Constitution of the State of th
W73-02700 81	ments in Zones of Rising Currents, W73-02748 5B	Biogrid Unit and Method, W73-03001 5D
BENEFICIAL USE	Standard Doyne I Like Cycle and Think	the Control Left and the Assessment Stuff.
Handling Hot Water, With A Payoff, W73-02780 5G	Bioassays of Quality in Water Resources of Major Importance to New Mexico, W73-02876 5C	Process for Removing Contaminants from Waste-Water, W73-03003 5D
BENEFIT-COST ANALYSIS Environmental Benefit-Cost Analysis for	A C-14 Assay for Photorespiration in Aquatic	Biochemical Sewage Treatment Via High Puri-
Nuclear Power Generation, W73-02840 6B	Plants, W73-02978 5C	ty Molecular Oxygen, W73-03004 5D
BENEFIT EVALUATION A Computer Simulation Model for Flood Plain	The Influence of Low Substrate Sodium Levels Upon the Free Amino Acid Content of Cotton	BIOLOGY Tritium and Its Effects in the Environment - A
Development, Part 1: Land Use Planning and Benefit Evaluation,	Leaves, W73-03089 3C	Selected Literature Survey. W73-02720 5C
W73-02944 4A	A Simple Technique for Detecting Effects of	BIOMASS
BENEFITS Water Resources Management in Delaware,	Toxicants or Other Stresses on a Predator-Prey Interaction,	Relations Between Biomass and Species Diver- sity in Marine and Freshwater Zooplankton
W73-02622 6B	W73-03161 5C	Communities, W73-02967 SC
Integrated Management of Quantity and Quality of Urban Water Resources,	BIOCHEMICAL OXYGEN DEMAND Relating Kraft Waste Stream Properties to	W73-02967 5C On the Phytoplankton of Waters Polluted by a
W73-02666 5G	Biochemical Oxygen Demand,	Sulphite Cellulose Factory, W73-02979 5C
A Methodology for Estimating the Benefits to		
Irrigated Agriculture from Increased Accuracy in Seasonal Streamflow Forecasts,	Removal of Phosphates from Sewage Effluent, W73-03000 5D	BIORHYTHMS Persisting Circadian Oscillations in Enzyme
W73-03130 3F	Municipal and Industrial Waste with Limited	Activity in Non-Dividing Cultures of Euglena, W73-02969 5C
Benefits of Flow Augmentation for Water Quality Control,	Water Resources, W73-03127 5F	BIRCH D
W73-03242 5G	BIOINDICATORS	Water Consumption in the Growth of Organic
BIBLIOGRAPHIES Bibliography on Handling, Control and Moni-	Application of Biological Monitoring Systems to Simulated Industrial Waste Discharge Situa-	Substances in Certain Biocoenoses in the Southern Taiga, (In Russian), W73-02688
toring of Tritium (Dec. 1968-Jan. 1972), W73-02708 5B	tions, W73-02617 5C	BITTERROOT-CLARK FORK RIVER BASIN
Tritium and Its Effects in the Environment - A	Periphyton and Phytobenthon as Indicators of	(MONT)
Selected Literature Survey. W73-02720 5C	Water Quality, W73-02625 5B	River Basin Modeling, an Approach to Com- puter Simulation of the Bitterroot-Clark Fork River Basin.
Ecological Techniques Utilizing Radionuclides	Salt Injury to Plants with Special Reference to	W73-02857 4A
and Ionizing Radiation. A Selected Bibliography,	Cations Versus Anions and Ion Activities, W73-03077 3C	BLOOD CHARACTERISTICS (FISH) Some Blood Characteristics in Black Baikal
W73-02746 5B	Effect of Lateral Development of Prosopis ju-	Grayling Thymallus articus Baicalensis Dyb. With Reference to the Estimation of the Grow-
BIG AND LITTLE SODA LAKES (NEV) Hydrologic Reconnaissance of Big and Little	liflora DC. Roots on Agricultural Crops, W73-03101 3F	ing Conditions (In Russian), W73-03111 81
Soda Lakes, Churchill County, Nevada, W73-03137 7C	BIOLOGICAL COMMUNITIES	
BIG AND LITTLE WASHOE LAKES (NEV)	Relations Between Biomass and Species Diver- sity in Marine and Freshwater Zooplankton	BLOOMING (PLANTS) Biology of the Blooming of Zizyphus Jujuba
Bathymetric Reconnaissance of Big and Little Washoe Lakes, Washoe County, Nevada,	Communities, W73-02967 5C	Mill (In Russian), W73-02676 3F
W73-03138 7C		BOATS
BIG LOST RIVER (IDAHO) Probability of Exceeding Capacity of Flood-	On the Phytoplankton of Waters Polluted by a Sulphite Cellulose Factory,	Jet Boat - Tellurometer Technique for Measur- ing Streamflow in Large Rivers,
Control System at the National Reactor Testing	W73-02979 5C BIOLOGICAL CRITERIA	W73-02646 7B
Station, Idaho, W73-02781 4A	Biological Aspects of Thermal Pollution, II.	BOGS Modes of Bog Development in the Ukrainian
BILBERRY D	Scientific Basis for Water Temperature Stan- dards at Power Plants,	Carpathians (In Russian), W73-02693 4A
The Water Economy of the Bilberry (Vaccinium myrtillus) Under Winter Conditions,	W73-02766 5C	Contents of Oxygen in Soil Water and CO2 in
W73-02705	BIOLOGICAL EFFECTS Electrical Energy Needs and Environmental	Soil Air in Forest Bogs of the Central Ukrainian Poleste (In Ukranian),
Toxicity and Spreading of Oil in Sea Water,	Problems, Now and in the Future. W73-02768	W73-03091 4A
W73-02903 5G	Biological Effects of Cooling Water Discharge,	Dynamics of Nutrients in Relation to the Hydrological Regime of Soils in Bog Forests of
BILGE WATER Characterization and Treatment of Bilge and	W73-02772 5C	the Southern Taiga in the Transurals (In Rus-
Ballast Water, W73-02905 5G	Biological Effects of Air Pollution, W73-02773 5C	sian), W73-03208 2G

Content Soil Air an Poles W73-036

Effects Anaesth Reaction Environ Dioxide W73-03

Acidity Young posed to W73-03

on Carb of Citru W73-03

Effects
Uptake
W73-03
CARIBBE
Palaeott
Ooze St
W73-02
CARP
Oxygen
of the 6
gy, (In 1
W73-02

Iodine ized Ca W73-02

Herbive (In Rus W73-02 Mangar gans at Russian W73-02

Distribution Used for W73-03

Change (Cyprin Ammor wodow Wplyw W73-03

CARP LA Daily Carp I (Pallas) W73-02

CARP PC Fertiliz Carp B W73-02

Momen Nonsta W73-03

CASPIAN Reprod Kura I tions, (W73-02

BOREHOLE GEOPHYSICS

BOREHOLE GEOPHYSICS The Use of Gamma Logs in Determining the	BRINE DISPOSAL Effect of Brine Disposal Cost on Hyperfiltra-	Geology and Ground Water of the Pajaro Val- ley Area, Santa Cruz and Monterey Counties,
Character of Unconsolidated Sediments and	tion Plant Optimization, W73-02914 5E	California,
Well Construction Features, W73-02802 4B	A 2 PRODUCT SA	W73-02603
BOTTOM-FEEDING FISH	Effect of Brine Disposal Cost on Hyperfiltra-	Slotted Corrugated Metal Pipe Drains, W73-02659 8A
The Role of Zoobenthos in the Feeding of Bot- tom-Feeding Fish and the Food Supply After	tion Plant Optimization, W73-02914 5E	'Apollo County Park', Waste Water Reclams-
the Damming of the Don (In Russian), W73-02677 2L	BRITISH COLUMBIA	tion Project for the Antelope Valley Area, Los Angeles County.
BOTTOM SEDIMENTS	A Survey of Some Possible Effects of Logging	W73-02867 5D
Palaeotemperature and Cohesion in Globigerina	on Two Eastern Vancouver Island Streams, W73-03160 4C	Water Requirements of Santa Barbara County,
Ooze Sediment Cores From the Caribbean Sea, W73-02797 2J	BROAD-CRESTED WEIRS	1967 to 1990, W73-02868 6D
The Relationship Between the Physical Proper-	Brink Depth for Trapezoidal Broad-Crested	to the Landwice Level Officials and
ties of Underwater Sediments That Affect Bottom Reflection.	Weir, W73-02788	An Approach for Involving Local Officials and Citizens in Regional Water Quality Studies,
tom Reflection, W73-02798 2J	BROWN SHRIMP	W73-02956 56
Slumping on the Eastern Margin of the Rockall	Commercial Shrimp FarmingNearing Reali-	Project Foggy Cloud III, Phase 1, W73-03145 3B
Bank, North Atlantic Ocean, W73-02799 2J	ty, W73-02932 3E	Programming Model of Regional Water Quality
	BRUSH CONTROL	Management,
The Use of Electrical Resistivity to Determine Porosity of Marine Sediments,	Morphological Response of Two Mesquite	W73-03240 5G
W73-03141 2J	Varieties to 2,4,5-T and Picloram, W73-03080 4A	CANADA Let Boat - Tellurometer Technique for Measur.
BOUNDARIES (SURFACES) The Structure of Turbulent Flows Adjacent to	BULGARIA	Jet Boat - Tellurometer Technique for Measur- ing Streamflow in Large Rivers,
The Structure of Turbulent Flows Adjacent to Walls,	Irrigation of Maize and Sunflower Grown as	W73-02646 7B
W73-03060 8B	Post-Harvest Silage Crops in the Region of Rossitza Irrigation System,	Glacier Surveys by District Personnel of the
BOUNDARY LAYERS	W73-02670 3F	Water Survey of Canada: 1. The Victoria Glaci- er,
Wave-Induced Boundary Layers in a Stratified Fluid,	BULLHEADS	W73-02648 2C
W73-02761 8B	Changes in the Blood of the Brown Bullhead (Ictalurus nebulosus (Lesueur)) Following	Multireservoir Analysis Techniques in Water
The Structure of Turbulent Flows Adjacent to Walls.	Short and Long Term Exposure to Copper (II),	Quantity Studies, W73-02664 4A
W73-03060 8B	Continued and formed present and	Progress Report, Biology and Health Physics
BOUNDARY PROCESSES	Antibodies Against Human Enteric Bacteria in Brown Bullheads (Ictalurus Nebulosus,	Division, Environmental Research Branch,
Temperature Effects in High-Transport, Flat- Bed Flows,	Leseuer) from Contaminated Waters,	January 1972 to March 31, 1972, W73-02725 5C
W73-02789 2J	1620.500	A Survey of Some Possible Effects of Logging
Environmental Influence on the Pattern of	BUOYANCY Observations and Other Characteristics of	on Two Eastern Vancouver Island Streams,
Plant Communities Along the North Rim of the Grand Canyon,	Thermals,	W73-03160 4C
W73-03078 21	W73-02757 8B	Mathematical Models and their Use in Water Resources Decision-Making,
BRACHIONUS CALYCIPLORUS	On the Equilibrium of a Cable Connected to a	W73-03237 6A
Daily Rations and Nutritive Coefficients of Carp Larvae Fed on Brachionus Calyciflorus	Free-Floating Body Placed in a Stream,	CANADARAGO LAKE (N.Y.)
(Pallas), (In Russian),	W73-03062 8B	Sources of Nutrients in Canadarago Lake, W73-02859
W73-02886 8I	CADMIUM Determination of A Trace Amount of Codmium	SERVICE AND A COUNTY OF STREET AND A TIME
BRACKISH WATER Desalting as a Source of Water Supply,	Determination of A Trace Amount of Cadmium in Water by Atomic Absorption Spec-	CANAL DESIGN Effects of an Artificial Stream on Marine Com-
W73-02861 3A	trophotometry Combined with Ammonium Pyr- rolidine Dithiocarbamate-Methl Isobutyl	munities,
BRAZOS RIVER BASIN (TEX)	Ketone Extraction Using Large Aqueous	W73-03171 SC
Annual Compilation and Analysis of Hydrolog- ic Data for Cow Bayou, Brazos River Basin,	Phase/Solvent Rati os, W73-02939 5A	CANALS Hydrodynamic Pressure of Nonstationary Flow
Texas, 1970,	CALCIUM	in Canals Acting on Moored Ships,
W73-03147 7C	Application of Biological Monitoring Systems	W73-03033 8B
BREAKWATERS	to Simulated Industrial Waste Discharge Situa- tions,	The Adria (Monfalcone) - Danube Basin Inter- national Waterway,
Forces on a Submerged Breakwater, W73-03031 8B	W73-02617 5C	W73-03230 4A
BREEDING	CALIBRATIONS	CAPILLARY FRINGE
Fertilizer and Methods of Preparing the Soil in	Boundary Effects in Desaturation of Porous	Patterns of Water Uptake and Root Distribu-
Carp Breeding Ponds, (In Russian), W73-02749	Media, W73-03064 2G	tion of Soybeans (Glycine max.) in the Presence of a Water Table,
BREST POLESIE (USSR)	CALIFORNIA	W73-03114 3F
Soil Complexes in the East of the Brest	Public Attitudes Toward Reuse of Reclaimed	CARBON DIOXIDE
Polesie, (In Russian), W73-03006 2G	Water, W73-02601 5D	Freezing Oil Spills, W73-03013

Contents of Oxygen in Soil Water and CO2 in Soil Air in Forest Bogs of the Central Ukraini- an Poleste (In Ukranian),	CASPIAN SEA Mineral Waters Along the Eastern Edge of the Caspian Lowland (Mineral'nyye vody	CHEMICAL ANALYSIS Uranium Concentration in Recent Ocean Sediments in Zones of Rising Currents,
W73-03091 4A	vostochnoy okrainy Prikaspiyskoy vpadiny),	W73-02748 5B
Effects of Locomoter Restraint and of	W73-02813 4B	A Study on the Chemical Behavior of Zinc in
Anaesthesia with Urethane or MS-222 on the	CATADROMOUS SALIMONIFORM FISH	Chesapeake Bay Water Using Anodic Stripping Voltammetry,
Reactions of Young Salmon (Salmo salahrL.) to Environmental Fluctuations of pH and Carbon	The Biology of a Landlocked Form of the Nor- mally Catadromous Salmoniform Fish Galaxias	W73-02783 5B
Dioxide Tension, W73-03169 5C	Maculatus (Jenyns): I. Life Cycle and Origin, W73-02855	Chemical and Bacteriological Quality of Water
and the state of t	The second Hanner Charmer of The World	at Selected Sites in the San Antonio Area, Tex-
Acidity and Lactate Content in the Blood of Young Atlantic Salmon (Salmo salar L.) Ex-	The Biology of a Landlocked Form of the Nor- mally Catadromous Salmoniform Fish Galaxias	as, August 1968-April 1972, W73-02808
posed to High pCO2, W73-03170 5C	Maculatus (Jenyns): II. Morphology and Syste-	Development of Analytical Procedures for
W73-03170 SC	matic Relationships, W73-02856 2I	Determining Chlorinated Hydrocarbon
Effect of Several Transpiration Suppressants on Carbon Dioxide and Water Vapor Exchange	The second section of the section of th	Residues in Waters and Sediments From Storage Reservoirs.
of Citrus and Grapevine Leaves,	CATFISHES Catfish Production in Southeastern Arkansas:	W73-02844 5A
W73-03192 2D	Estimated Investment Requirements, Costs,	CHEMICAL CONTROL
Effects of Water Stress on the Resistance to Uptake of Carbon Dioxide in Tobacco,	and Returns, for Two Sizes of Farms, W73-02926 3E	Morphological Response of Two Mesquite Varieties to 2,4,5-T and Picloram,
W73-03193 3F	CATION EXCHANGE	W73-03080 4A
CARIBBEAN	Desalting and Purifying Water by Continuous	CHEMICAL OXYGEN DEMAND
Palaeotemperature and Cohesion in Globigerina	Ion Exchange, W73-02998 3A	Anaerobic Treatment of Starch Wastewaters,
Ooze Sediment Cores From the Caribbean Sea,		W73-02619 5I
W73-02797 2J	CATIONS Salt Injury to Plants with Special Reference to	Municipal and Industrial Waste with Limited
Oxygen Consumption of Larvae and Juveniles	Cations Versus Anions and Ion Activities,	Water Resources, W73-03127
of the Carp Family in Relation to Their Ecolo-	W73-03077 3C	CHEMICAL REACTIONS
gy, (In Russian), W73-02682 81	CEMENTS	A Study on the Chemical Behavior of Zinc is
	New Materials in Concrete Construction. W73-03247 8F	Chesapeake Bay Water Using Anodic Stripping Voltammetry,
Iodine Content in the Water and Soil of Fertil- ized Carp Ponds, (In Russian),	THE RESIDENCE OF STREET WAS ASSESSED.	W73-02783 5E
W73-02711 81	CHAETOMORPHA Fine Structure of Swarmers of Cladophora and	CHEMICAL TREATMENT
Herbivorous Fish in Ponds for Peat Production,	Chaetomorpha. III. Wall Synthesis and Development,	Removal of Dissolved Oxygen from Water, W73-02988
(In Russian), W73-02718 8I	W73-02966 5C	
Manganese, Zinc and Copper Content in Or-	CHANNEL EROSION	Process for Detoxifying Cyanide Waste Waters,
gans and Tissues of Carp Underyearlings, (In	Late-Stage Meander Growth,	W73-02989 · 5I
Russian), W73-02884 5B	W73-02796 2J	Neutralization of Ferrous Iron-Containing Acid
	CHANNEL IMPROVEMENT Fall River Harbor, Massachusetts and Rhode	Wastes, W73-02993
Distribution of Red Spot Disease in Waters Used for Fish Breeding (In Russian),	Island (Draft Environmental Impact State-	200
W73-03109 5C	ment). W73-03144 8A	Removal of Phosphates from Sewage Effluent, W73-03000
Changes in the Peripheral Blood in Carp		CHEMICAL WASTES
(Cyprinus Carpio L.) Under the Influence of	CHANNEL MORPHOLOGY Two Models for Horton's Law of Stream Num-	Process for Detoxifying Cyanide Wast
Ammonium Liquor (Zmiany we Krwi Ob- wodowej Karpis (Cyprinus Carpio L.) Pod	bers,	Waters, W73-02989 51
Wplywem Wody Amoniakalnesj,	W73-03079 4A	
W73-03158 5C	CHANNELS	Oxidative Waste Disposal, W73-03008
CARP LARVAE Daily Rations and Nutritive Coefficients of	Effects of an Artificial Stream on Marine Com- munities.	CHERRY D
Carp Larvae Fed on Brachionus Calyciflorus	W73-03171 5C	Cherry Yields as Conditioned by Soil Moistur
(Pallas), (In Russian), W73-02886	CHECK STRUCTURES	(In Russian),
	Probability of Exceeding Capacity of Flood-	W73-02679
CARP PONDS Fertilizer and Methods of Preparing the Soil in	Control System at the National Reactor Testing Station, Idaho,	CHESAPEAKE BAY A Study on the Chemical Behavior of Zinc i
Carp Breeding Ponds, (In Russian),	W73-02781 4A	Chesapeake Bay Water Using Anodic Strippin
W73-02749 8I	Trajectory of Floating Bodies in a Strongly	Voltammetry, W73-02783
CASCADES (PIPE FLOW)	Deviating Fluid Vein, (Trajectoire de corps	and a facility of the control of the
Moment Characteristics of Cascades Under Nonstationary Flow Conditions.	flottants dans une veine fluide fortement device).	CHESAPEAKE BIGHT Autumn and Winter Occurrence of Decapo
W73-03029 8B	W73-03035 8B	Crustaceans in Chesapeake Bight, U.S.A.,
CASPIAN LAMPREY	CHELATION	W73-02694
Reproduction of the Caspian Lamprey in the	Feasibility Study of the Application of Solvent	CHINOOK SALMON
Kura Basin Under Hydroconstruction Condi- tions, (In Russian),	Extraction and Gas-Liquid Partition Chro- matography to Marine Trace Metal Analysis,	Low Level Chronic Irradiation of Salmon. As nual Progress Report,
W73-02684 5C	W73-02747 5A	W73-02714 5

G

Compar Behavio W73-02

2J

CHINOOK SALMON

Estimates of Maturation and Ocean Mon		CITRUS D LEAVES	
for Columbia River Hatchery Fall Chinoo		Effect of Several Transpiration Suppressants	Africa,
mon and the Effect of No Ocean Fishin	ing on	on Carbon Dioxide and Water Vapor Exchange	W73-03100 2B
Yield, W73-02927	81	of Citrus and Grapevine Leaves, W73-03192 2D	CLINTON COUNTY (PENN.)
			A Water Supply-Demand Analysis in Clinton
CHLORELLA		CITY PLANNING	County, Pennsylvania: A Study in Economic
The Interaction of Sewage, Thermal, and	1 Acid	Future Environments of Arid Regions of the	Hydrology,
Mine Water Loadings on the Growt	th of	Southwest.	W73-02610 6D
Chlorella,		W73-03118 6B	CLOUD CHAMBER DESIGN
W73-02974	5C	The Future Human Occupance of the Arid	Cloud Chamber Design for Water Evaporation
CHLORIDES		Southwest,	Studies, Management of the value of
Isopiestic Determination of Solubilitie	es in	W73-03121 6B	W73-02889 2B
Mixed Salt Solutions. Two Salt Systems,	Mag-	Planning our Urban Environment in the	CLOUD PHYSICS
W73-03063	2K	Southwest,	Cloud Chamber Design for Water Evaporation
tree to Weletz and Solventy of and	Scott.	W73-03124 6B	Studies,
CHLORINATED HYDROCARBON PESTIC		CATHERES	W73-02889 2B
Development of Analytical Procedure		New Towns for the Southwest,	An Expension Claud Chamber Study of Water
Determining Chlorinated Hydroc		W73-03125 6B	An Expansion Cloud Chamber Study of Water Evaporation.
Residues in Waters and Sediments Storage Reservoirs,	From	CLADOPHORA	Evaporation, W73-02890 2B
W73-02844	5A	Fine Structure of Swarmers of Cladophora and	Typolin of Carron Disable in Lablocat
All and the second second	34	Chaetomorpha. III. Wall Synthesis and	CLOUD SEEDING
Organochlorine Insecticide, Herbicide		Development,	Performance of an Atmospheric Water
Polychlorinated Biphenyl (PCB) Inhibiti	ion of	W73-02966 5C	Resources Research Program in the Hungry
Nakatpase in Rainbow Trout,	ITTO.	CLARIFICATION	Horse Area, Montana. W73-03143
W73-03165	5C	Biochemical Sewage Treatment Via High Puri-	THE STATE OF THE S
CHLOROPHYLL		ty Molecular Oxygen,	Gromet IIRainfall Augmentation in the Philip-
Diel Periodicity of Chlorophyll a Concent	tration	W73-03004 5D	pine Islands,
in Oregon Coastal Waters,		The state of the s	W73-03149 3B
W73-02970	5C	CLASSIFICATION SYSTEM	CLOUDBURSTS
	HE A.	A Land-Use Classification System for Use With Remote-Sensor Data.	Map Showing Drainage Basins and Historic
CHLOROPHYLL A		With Remote-Sensor Data, W73-02649 7B	Cloudburst Floods in the Salina Quadrangle,
Growth of the Bay Scallop: The Influer	nce of	11.3-020-5	Utah, which has seen well in harmon maked
Experimental Water Currents,		CLAYS	W73-03152 7C
W73-02702	2L	Transfer Properties and Friction Coefficients	COAGULATION
Diel Periodicity of Chlorophyll a Concent	tration	for Salt and Water Flow Through Clays,	A New Approach for Water Reclamation -
in Oregon Coastal Waters,		W73-02829 2G	Complete Treatment of Waste Water by
W73-02970	5C	Vertical and Horizontal Laboratory Permeabili-	Physico-Chemical Processes,
MALE TOP THE TANK A TOP TO THE		ty Measurements in Clay Soils,	W73-02607 5D
CHLOROPHYTA	HIW.	W73-02833 2G	Process for Removing Contaminants from
Surface Phytoplankton and Some Aspe		L. WYSTOSTW	
the Physical-Chemical Limnology of Areas on Lake Texoma,	Ihree	The Flow of Air and Water in Partly Saturated	Waste-Water, W73-03003
W73-03072	2Н	Clay Soil, W73-02834 2G	
	211	# 13-02834 2G	COASTAL ENGINEERING
CHROMATOGRAPHY		An Investigation into the Flow Behaviour	A Glossary of Coastal Engineering Terms.
A System for the Rapid Analysis of O		Through Compacted Saturated Fine-Grained	W73-02654 8B
Phosphorus in Water Samples or Fra	actions	Soils with Regard to Fines Content and Over a	COASTER GATES
from Chromoatographic Columns,		Range of Applied Hydraulic Gradients,	Hydraulic Downpull Increase at a Dam Gate
W73-02968	5A	W73-02835 2G	Caused by Hydrodynamic Forces,
CHRONIC EFFECTS		CLEANING	W73-03043
An Approach to the Problem of Pollutio	on and	Cleaning Water Mains With Foam PlugsEx-	COASTS
Fisheries.	LITTE	perience at Washington, D. C.,	Diel Periodicity of Chlorophyll a Concentration
W73-03163	5C	W73-02862 5G	in One on Constal Water
	CHESIN	CLEANIB COOKS	W73-02970 5C
		CLEANUP COSTS The Containment and Recovery of Navy Oil	
Damage to Karnafuli Dam Spillway,		SpillsA Financial Analysis,	COCKLES Nucella legillus (I) As a Predator of Edible
W73-02787	8B	W73-02909 5G	Nucella lapillus (L.) As a Predator of Edible Cockles,
CHUTES			W73-02703 2L
Damage to Karnafuli Dam Spillway,		CLEAR-CUTTING	I criffort and Melade of Preparing file and in
W73-02787	8B	A Survey of Some Possible Effects of Logging	CODORUS CREEK (PENN)
		on Two Eastern Vancouver Island Streams, W73-03160 4C	The Codorus Creek Wastewater Management
CINCINNATI (OHIO)		Everything Found Value, (Translated on them	Study, Summary Report and Conclusions. W73-02869 5G
What Water and Waste Water Parar	meters	CLIMATIC DATA	12 Danie March de destricte de March
Should We Measure,	Author	Energy Input-Output Climates of the World: A	Codorus Creek Water Quality Investigation Re-
W73-02976	5A	Preliminary Attempt,	port, Office The Property of t
CIRCUITS		W73-02647 2B	W73-02870 5G
Transistorized Level Switching Circuits	s (On	CLIMATOLOGY	COHESION
Off Controller) and their Possible Applic		Energy Input-Output Climates of the World: A	Palaeotemperature and Cohesion in Globigerina
to Water Passarvoir: II	P1 74	Dealiminant Attempt	Oore Cediment Cores From the Caribbean Con

2B

W73-02797

W73-02647

4A

W73-03198

CONTAMINATED SEDIMENT PARTICLES

COLIFORM Pollution by Coliform Bacteria in Sea Water of	COMPETING USES	CONCRETE TECHNOLOGY
Swimming Resorts: II (In Japanese),	Organizational Aspects of Irrigation Systems, W73-03106 3F	Concrete-Polymer Materials-Fourth Topical Report.
W73-02928 5B	Difference of the second	W73-02845 RF
COLIFORMS	Organizational Alternatives in Consolidating Ir-	WTLOTTIC 31
The Occurrence and Possible Source of the	rigation Systems, W73-03107 3F	New Materials in Concrete Construction. W73-03247
Coliform Bacteria on the Shoreline of Northern	and white the property of the fact of the state of the st	And the second line of the secon
Lake Michigan, W73-02606 5B	COMPETITION Effect of Lateral Development of Prosopis ju-	CONDENSATION
W73-02006	liflora DC. Roots on Agricultural Crops,	Project Fog Drops. Part 1: Investigations of Warm Fog Properties,
Pollution Studies of the Regional Ogallala	W73-03101 3F	W73-02782 2B
Aquifer at Portales, New Mexico, W73-02891 5B	COMPRESSIBILITY	Continued Market of the District of
	· Experimental Study of the Structure of Turbu-	Centrifugal, Multieffect Distillation Apparatus, W73-02986
COLORADO Water Resources Data for Colorado, 1971: Part	lent Boundary Layers in Incompressible Fluids	Commission Dept.
1. Surface-Water Records.	in the Presence of a Longitudinal Pressure Gradient,	Condensation Processes in Non-Irrigated Soils
W73-02643 7C	W73-03061 8B	(In Russian), W73-03211 2G
COLUMBIA RIVER		Commission of Reservoir Systems
Columbia River Interstate Compact, Politics of	A New Data Base for Syntax-Directed Pattern	CONDUCTIVITY Relating Kraft Waste Stream Properties to
Negotiation,	Analysis and Recognition,	Biochemical Oxygen Demand,
W73-02614 6E	W73-02885 7C	W73-02940 5B
Radioactive and Stable Nuclides in the Colum-	COMPUTER MODELS	CONFERENCES
bia River and Adjacent Northeast Pacific Ocean,	The River Basin Model: The Social Science	Technology Transfer in Water Research-The
W73-02745 5B	Laboratory.	Interface Between Producers and Users.
	W73-02853 6B	W73-02877 6B
Columbia River Effects in the Northeast Pacific: Biological Studies. Progress Report,	River Basin Modeling, an Approach to Com-	CONFINED WATER
July 1971-June 1972.	puter Simulation of the Bitterroot-Clark Fork	Groundwater of the Akdala River Valley and
W73-02750 5B	River Basin. W73-02857 4A	Prospects of its Use as a Water-Supply Source
Columbia River Effects in the Northeast	TO 11 18 32 70 16 73 16 5 1	(Podzemnyye vody doliny r. Akdala i perspek- tivy ikh ispol'zovaniya dlya vodosnabzheniya),
Pacific: Chemical and Geological Studies.	COMPUTER PROGRAMS	W73-02817 4B
Progress Report, Sept. 1971 to May 1972. W73-02751 5B	General Purpose Program of Plane Stress Anal- ysis by Finite Element Method, and its Appli-	CONNECTICUT
W73-02751 5B	cation,	Water Research at the University of Connec-
Estimates of Maturation and Ocean Mortality	W73-02852 8A	ticut.
for Columbia River Hatchery Fall Chinook Sal- mon and the Effect of No Ocean Fishing on	A Computer Program for Calculating Nutrient	W73-02631 9A
Yield.	Balances,	Location of Wells and Test Holes, Hartford
W73-02927 8I	W73-02858 1 7C	North Quadrangle, Connecticut,
Methods for the Characterization of Suspended	A New Data Base for Syntax-Directed Pattern	W73-03153 7C
Sediment and Selected Applications for the	Analysis and Recognition,	Sites of Solid-Waste Storage and Liquid-Waste
Acquired Data,	W73-02885 7C	Discharge, Hartford North Quadrangle, Con-
W73-02977 5B	A Computer Simulation Model for Flood Plain	necticut, W73-03154 7C
COMBUSTION	Development, Part 1: Land Use Planning and Benefit Evaluation.	Police Control of the
Electrical Energy Needs and Environmental Problems, Now and in the Future.	W73-02944 4A	Maximum Concentration of Dissolved solids in
W73-02768 5C		Surface Water, Hartford North Quadrangle, Connecticut,
ACCUPATION OF THE PROPERTY OF	Use of Digital Computers for the Heat and Mass Transfer Analyses of Controlled Environ-	W73-03155 7C
COMBUSTION PRODUCTS Air Pollution from Combustion Products,	ment Greenhouses,	CONOMBLICATION MARRIAGE
W73-02771 5C	W73-03082 2D	New Materials in Concrete Construction.
COMMERCIAL OPERATIONS	Solution of Continuity and Momentum Equa-	W73-03247 8F
Commercial Shrimp FarmingNearing Reali-	tions of a Travelling Hydraulic Jump by Using	CONSUMERS' SURPLUS
ty,	an Iterative Operator,	Multi-Disciplinary Study of Water Quality
W73-02932 3E	W73-03150 8B	Relationships: A Case Study of Yaquina Bay,
COMMUNITY AGREEMENT	Problem-Oriented Computer Languages in	Oregon,
Community Values: A Strategy for Project	Hydraulic Engineering: A Brief Overview of Their Evolution, State of the Art and Future,	W73-02921 5C
Planning, W73-02854 6B	W73-03245 7C	CONSUMPTIVE USE
	COMPLETEDE	A Contribution to the Study of Transpiration in Woody Species (In Czech.),
COMMUNITY DEVELOPMENT New Towns for the Southwest.	COMPUTERS Systems Approach to Problems of Water Pollu-	W73-02950 2D
W73-03125 6B	tion Control,	
COMPACTION	W73-03222 5G	Agricultural Wastes in Arid Zones, W73-03128 5F
Vertical and Horizontal Laboratory Permeabili-	CONCRETE CONSTRUCTION	
ty Measurements in Clay Soils,	New Materials in Concrete Construction.	Discussion of Waste Disposal in Arid Lands,
W73-02833 2G	W73-03247 8F	W73-03129 5F
COMPARATIVE STUDIES	CONCRETE-POLYMER MATERIALS	CONTAMINATED SEDIMENT PARTICLES
Comparison of Analytical and Structural	Concrete-Polymer MaterialsFourth Topical	Dispersion of Contaminated Bed-Load Parti- cles,
Behavior Results for Morrow Point Dam, W73-02847 8A	Report, W73-02845 8F	W73-02650 5B
, and the same of		

CROP PR Studies Plants:

Summe W73-03

Perform

(Gossyp Times,

Nitroge: Pradesh

W73-032

Soils of

bilities Russian W73-032

CROP RES

Effects Reaction W73-026

Effect o liflora De W73-031

CROP YIE

Cherry Y (In Russi

W73-026

CRUSTAC

Autumn Crustace: W73-0269

The Infl Respiration lus (O.F. W73-0316

CULTIVAT Influence

Structure W73-0320 CULTURES Persisting

Activity is W73-0296

Culture, Tolerance

tory, W73-0316

CURRENTS Non-Stead Roughness W73-03040

CYANIDE Process Waters, W73-02989

CYANOPHY Ecology (

Systems: 1 Diversity of Mat, W73-02980

Surface Ph the Physic Areas on L W73-03072

5G

SE.

CONTINENTAL SHELF

CONTINENTAL SHELF	COPPER	COSTS
Synoptic Measurements of Currents and Sedi-	Manganese, Zinc and Copper Content in Or-	Water Resources Management in Delaware,
ment Transport on the Continental Shelf. An-	gans and Tissues of Carp Underyearlings, (In	W73-02622 6B
nual Progress Report,	Russian),	ACCOUNTS TO THE PROPERTY.
W73-02716 2L	W73-02884 5B	Integrated Management of Quantity and Quali-
	Change is the Bland of the Bosses Bullband	ty of Urban Water Resources,
CONTINUITY EQUATION	Changes in the Blood of the Brown Bullhead (Ictalurus nebulosus (Lesueur)) Following	W73-02666 5G
Solution of Continuity and Momentum Equa-	Short and Long Term Exposure to Copper (II),	Oil Spill Characteristics and Statistics,
tions of a Travelling Hydraulic Jump by Using	W73-02947 5C	W73-02906 5G
an Iterative Operator,	the period to aduct at the more fight, programmer	A STATE OF THE PARTY OF THE PAR
W73-03150 8B	Process and a Product for the Purification of	Capital and Operating Costs for Conventional
CONTROL	Polluted Water from Heavy Metal Ions Present	and Advanced Waste Treatment.
Location and Equipment for Oil Recovery	Therein,	W73-02913 5D
Teams in San Diego,	W73-02992 5D	Cost Analysis of Optional Methods of Ship-
W73-02910 5G	CORES	board Waste Disposal.
THE OWNER OF THE OWNER OF THE PARTY OF	Origin of Manganese Nodules of the Pacific	W73-02916 5E
An Alternative Approach for Finding Optimal	Ocean From Radioisotope Data,	DATE OF THE PARTY
Control Rules of Reservoir Systems,	W73-02752 5B	Systems Approaches to Microscale Problems
W73-03231 4A	MANAGEN AND SET OF THE	of Water Pollution Control, W73-03223 5G
CONTROL GUIDELINES	CORN	W 73-03223
	Variations in Sodium Uptake Along Primary Roots of Corn Seedlings,	The Miami Conservancy District Experience in
An Experiment in Computer-Assisted Super- visory Control of a Water Distribution System,	W73-03085 3C	the Systems Approach to Water Quality Im-
W73-02871	# 75-030E3	provement,
W/3-02071	CORN (FIELD)	W73-03225 50
CONTROLLERS	Relationship of Plant Moisture Status to Irriga-	A Rough And Round Almosistes for Regional
Transistorized Level Switching Circuits (On	tion Need in Corn and Soybean Crops,	A Branch-And-Bound Algorithm for Regional Water Quality Management,
Off Controller) and their Possible Applications	W73-02604 2I	W73-03243 56
to Water Reservoir: II,	Effects of Detergent Polluted Water on Soil	# 15-05245
W73-03198 4A	Reaction and Plant Growth,	COTTON
THE RESERVE THE PROPERTY OF TH	W73-02620 5C	The Influence of Low Substrate Sodium Levels
CONVECTION	W 73-02020	Upon the Free Amino Acid Content of Cotton
Some Aspects of Heat and Mass Transfer in	CORPS OF ENGINEERS	Leaves,
Porous Media,	Aggregate Returns from Water Resource	W73-03089 3C
W73-02823 2F	Development in Georgia, 1946 -1965,	An Effect of Water Stress on Ethylene Produc-
On the Derivation of a Convective-Dispersion	W73-02919 6B	tion by Intact Cotton Petioles.
Equation by Spatial Averaging,	CORRUGATED METAL PIPES	W73-03112 3F
W73-02832 2F	Slotted Corrugated Metal Pipe Drains,	A CONTRACTOR OF THE PROPERTY O
Toronion of Wolle and Pear Maked Whisting	W73-02659 8A	Performance of Rainfed American Cotton
CONVECTIVE DISPERSION	117 0207	(Gossypium hirsutum L.) under Three Sowing
On the Derivation of a Convective-Dispersion	COST ALLOCATION	Times, Three Row Spacings and Three
Equation by Spatial Averaging,	A Businesslike Approach to Fire Prtoection	Nitrogen Levels in Nimar Tract of Madhya
W73-02832 2F	Charges.	Pradesh, W73-03201 3F
Authorities Grating Control Control Control	W73-02864 3D	W 73-03201 3F
COOLING	Taxation and Pollution-Some Comments,	COW BAYOU (TEX)
Sounding The All-In-One Nuclear Drum.	W73-02935 5G	Annual Compilation and Analysis of Hydrolog-
W73-02764 5G	The state of the s	ic Data for Cow Bayou, Brazos River Basin,
Electrical Energy Needs and Environmental	Cost Allocation for A Regional Pollution Treat-	Texas, 1970,
Problems, Now and in the Future.	ment System,	W73-03147-
W73-02768 5C	W73-02937 5G	CRACKS
W 75-02100 JC	COST ANALYSIS	Stresses and Movements in Oroville Dam,
COOLING TOWER PLUMES	A Businesslike Approach to Fire Prtoection	W73-02849 8D
A Method for Calculating the Size of Cooling	Charges.	30.000
Tower Plumes,	W73-02864 3D	CRAFTS
W73-02763 5G		Village Technology Handbook.
Madiciples and period that	COST-BENEFIT ANALYSIS	W73-02922 , 8A
COOLING TOWERS	Urban Sedimentation-In Perspective,	CRAYFISH
A Method for Calculating the Size of Cooling	W73-02793 2J	Exploitation of Crayfish by Largemouth Bass
Tower Plumes,	Systems Analysis and Water Quality Manage-	in a Small Ohio Pond,
W73-02763 5G	ment,	W73-02704 81
COOLING WATER	W73-02943 5G	100000000000000000000000000000000000000
Biological Effects of Cooling Water Discharge,		CRITERIA
W73-02772 5C	COST EFFECTIVENESS	Electrical Energy Needs and Environmental
30	Immediate Cost-Effective Abatement of Water	Problems, Now and in the Future.
COOLING WATER CONDITIONING	Pollution from Navy Ships.	W73-02768 5C
Fouling: The Major Unresolved Problem in	W73-02901 5G	CRITICAL FLOW
Heat Transfer,	Location and Equipment for Oil Recovery	Theoretical Study on Flap Gate Oscillation,
W73-02775 8B	Teams in San Diego,	W73-03044 88
	W73-02910 5G	
COPIAH COUNTY (MISS)		CROP MOISTURE STATUS
Water for Industrial Development in Copiah	COST REDUCTIONS	Relationship of Plant Moisture Status to Irriga-
and Simpson Counties, Mississippi,	Net A Profit From Farm Fish Crop,	tion Need in Corn and Soybean Crops,
W73-02651 3E	W73-02924 3E	W73-02604 21

		DECISION MAKING
CROP PRODUCTION	CYTOLOGICAL STUDIES	DATA COLLECTIONS
Studies on the Physiological Nature of Alfalfa Plants: 9. Effect of soil Moisture on the	Fine Structure of Swarmers of Cladophora and Chaetomorpha. III. Wall Synthesis and	Environmental Monitoring in the Vicinity of the Los Alamos Scientific Laboratory, July
Summer Growth of Alfalfa (In Japanese),	Development,	through December 1971. W73-02719 5B
W73-03200 3F	W73-02966 5C	middle to the state of the stat
Performance of Rainfed American Cotton (Gossypium hirsutum L.) under Three Sowing	Effects of Salt Treatments of Cotton Plants (Gossypium hirsutum L.) on Leaf Mesophyll	Codorus Creek Water Quality Investigation Report, W73-02870 5G
Times, Three Row Spacings and Three Nitrogen Levels in Nimar Tract of Madhya	Cell Microstructure, W73-03081 3C	Data Collection for Water Systems Control,
Pradesh, W73-03201 3F	Response of Osmotically Stressed Plants to Growth Regulations,	W73-03241 7C
Soils of Piedmont Debris Cones and the Possi- bilities for their Agricultural Utilization (In	W73-03104 3C	DATA STORAGE AND RETRIEVAL A New Data Base for Syntax-Directed Pattern Analysis and Recognition,
Russian), W73-03209 2G	DALLAS (TEX) Annual Compilation and Analysis of Hydrolog-	W73-02885 7C
CROP RESPONSE	ic Data for Urban Studies in the Dallas, Texas Metropolitan Area, 1970,	DECAPOD CRUSTACEANS Autumn and Winter Occurrence of Decapod
Effects of Detergent Polluted Water on Soil Reaction and Plant Growth,	W73-02652 7C	Crustaceans in Chesapeake Bight, U.S.A., W73-02694 2L
W73-02620 5C	DAM FAILURE	DECISION MAKING
Effect of Lateral Development of Prosopis ju-	Damage to Karnafuli Dam Spillway, W73-02787	Improved River Basin Utilization Through Systems Analysis,
liflora DC. Roots on Agricultural Crops, W73-03101 3F	Examples of the Internal Condtions of Some	W73-02665 6A
CROP YIELD Cherry Yields as Conditioned by Soil Moisture	Old Earth Dams, W73-02841 8A	Environmental Benefit-Cost Analysis for Nuclear Power Generation,
(In Russian),	Internal Piping and Shear Deformation Victor	W73-02840 6B
W73-02679 3F	Braunig Dam - San Antonio, Texas, W73-03250 8D	The River Basin Model: The Social Science Laboratory.
CRUSTACEANS	DAM FOUNDATIONS	W73-02853 6B
Autumn and Winter Occurrence of Decapod Crustaceans in Chesapeake Bight, U.S.A.,	Internal Piping and Shear Deformation Victor	Towards a Philosophy of Planning: An Investigation into Attitudes Held by Federal
W73-02694 2L	Braunig Dam - San Antonio, Texas, W73-03250 8D	Water Resource Planners,
The Influence of Herbicide 2,4-D-NA on Respiration and Survival of Simocephalus vetu-	DAMS	W73-02955 6E
lus (O.F. Muller) (Cladocera), W73-03166 5C	Probability of Exceeding Capacity of Flood- Control System at the National Reactor Testing Station, Idaho,	An Approach for Involving Local Officials and Citizens in Regional Water Quality Studies, W73-02956 5G
CULTIVATION Influence of Shape of Implements on Soil	W73-02781 4A	Ecological River Basin Management,
Structure, W73-03203 2G	Superdams: The Perils of Progress, W73-02850 6G	W73-03092 6E
	11/2017/07	Organizational Aspects of Irrigation Systems, W73-03106 3F
CULTURES Persisting Circadian Oscillations in Enzyme	On the Optimization of the Design of Storage Areas at River Dams, W73-03239 4A	Future Environments of Arid Regions of the
Activity in Non-Dividing Cultures of Euglena, W73-02969 5C	William Area with the wrest	Southwest. W73-03118 6B
Charles and Thomas	DANUBE FLOODPLAIN Considerations Regarding Distribution of	Future Environments of Arid Lands of
Culture, Reproduction, and Temperature Tolerance of Pontoporeia affinis in the Labora- tory,	Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (In Rumanian),	Southwestern States, W73-03119 6B
W73-03168 5C	W73-02686 21	A Land-Use Plan for the Arid Southwest,
CURRENTS (WATER)	DAPHNIA MAGNA	W73-03120 6B
Non-Steady Flow on Sloping Beach with Large Roughness Elements,	Identification of Toxic Components in Oil Refinery Effluents and Determination of Their Effect Upon the Aquatic Biota,	The Future Human Occupance of the Arid Southwest,
W73-03040 2E	W73-02609 SA	W73-03121 6B
CYANIDE Process for Detoxifying Cyanide Waste	DARCYS LAW	Public Land Management in the Arid Southwest,
Waters, W73-02989 5D	An Investigation into the Flow Behaviour Through Compacted Saturated Fine-Grained	W73-03122 6B
СУАПОРНУТА	Soils with Regard to Fines Content and Over a Range of Applied Hydraulic Gradients,	Arid Lands and Their Future, W73-03123 6B
Ecology of Yellowstone Thermal Effluent Systems: Net Primary Production and Species	W73-02835 2G Non-Darcian Flow of Water in SoilsLaminar	New Towns for the Southwest, W73-03125 6B
Diversity of a Successional Blue-Green Algal Mat,	Region,	Environmental Planning and Ecological Possi-
W73-02980 5C	W73-02836 2G	bilities, W73-03184 6G
Surface Phytoplankton and Some Aspects of the Physical-Chemical Limnology of Three	A New Data Base for Syntax-Directed Pattern	Systems Approach to Problems of Water Pollu-
Areas on Lake Texoma, W73-03072 2H	Analysis and Recognition, W73-02885 7C	tion Control, W73-03222 SG

SD

BA

81 81

stal SC

iga-

21

DECISION MAKING

The Miami Conservancy District Experience in	Desalination, ENGITE JANDOLOGY	DICHLOROHYDRIN
the Systems Approach to Water Quality Im-	W73-03005 3A	Process and a Proc
provement, W73-03225 5G	Separator-Melter Unit for Desalination,	Polluted Water from Therein.
Great Lakes Simulation ModelA Decision	W73-03012 3A	W73-02992
Aid.	An Integrated System for Providing Power,	DIELDRIN
W73-03234 2H	Water and Food for Desert Coasts,	A Laboratory Study
Mathematical Models and their Use in Water	W73-03099 3F	to Fresh Water Inve
Resources Decision-Making,	DESALINATION PROCESSES	W73-02695
W73-03237 6A	Desalting as a Source of Water Supply,	DIETS (FISH)
DECOMPOSITION	W73-02861 3A	Fish of the Kuibysh
Optimal Operation of Serially-Linked Water	DESERT PLANTS	W73-03083
Reservoirs,	Mineral Ion Composition of Halophytic Species	DIFFUSER PIPES
W73-02707 4A	from Northern Utah,	Hydrodynamic For
DEEPWATER PORTS (USA)	W73-03117 2I	to Barge Passage, W73-03032
U. S. Deepwater Port Study-The Environmen-	DESIGN	₩ /3-03032
tal and Ecological Aspects of Deepwater Ports. W73-03136	Systems Approaches to Microscale Problems	DIFFUSION
	of Water Pollution Control, W73-03223 5G	Diffusion of Then
DEER CREEK RESERVOIR (UTAH)	The state of the s	into a Moving Wate W73-02627
The Yellow Perch Fisheries of Deer Creek Reservoir, Utah, with Notes on Parasitism by	On the Optimization of the Design of Storage	
Ligula Intestinalis,	Areas at River Dams, W73-03239	Some Aspects of 1
W73-02701 8I	W73-03239	Porous Media, W73-02823
DELAWARE	DESIGN CRITERIA	and the state of t
Water Resources Management in Delaware,	FWQA Sets Rules for Sewage Treatment Plant Design.	Turbulent Thermal
W73-02622 6B	W73-02958 5D	Flowing into a Mov. W73-02895
The Availability of Ground Water in New Cas-	Character and Print Courts. District	117-02073
tle County, Delaware,	DESTRATIFICATION	DIGESTION
W73-02785 4B	Thermal Stratification and Thermocline Control in Storage Reservoirs,	The Effect of pH or W73-02897
The Availability of Ground Water in Eastern	W73-02777 5B	W 13-02691
Sussex County, Delaware,	OUTSIDE OF THE STREET	DIGITAL COMPUTE
W73-02805 4B	Control of Thermal Stratification in Thames Valley Reservoirs.	Application of a Di
The Availability of Ground Water in Kent	W73-02778 5B	Model to an Urbani W73-02946
County, Delaware, With Special Reference to	and an experience of the state	Marine and the
the Dover Area, W73-02806 4B	DETECTION Development of Analytical Procedures for	DILUTE SUSPENSIO
W/3-02606 4B	Determining Chlorinated Hydrocarbon	Transport Process Suspensions in Tur
DELAWARE ESTUARY	Residues in Waters and Sediments From	11,
Mathematical Models for Regional Economic and Waste Load Projection,	Storage Reservoirs,	W73-02605
W73-02920 5B	W73-02844 5A	DIPTERA
	DETERGENTS	Some Ecological
DENITRIFICATION Removal of Nitrogen and Phosphorus from	Effects of Detergent Polluted Water on Soil	Emergence in Prate
Waste Waters,	Reaction and Plant Growth, W73-02620 5C	W73-03162
W73-03002 5D	Construction Security visible Library	DIRECT CYCLE REA
Nitrate Transformations in Surface Waters; I.	DETERMINISTIC MODELS	Sounding The All-In
A Study of Various Factors Affecting the Rates	Systems Analysis and Water Quality Manage- ment,	W73-02764
of Denitrification and Immobilization in Sur-	W73-02943 5G	DISCHARGE COEFF
face Waters, and II. Characterization of the Surface Waters in the Wabash River and Three	PETER MINISTER CHETCHS	Aeration of Weirs,
Farm Ponds,	DETERMINISTIC SYSTEMS Some Extensions of Linear Systems Analysis	W73-03142
W73-03191 5B	in Hydrology,	DISCHARGE MEASU
DENSITY	W73-02662 2A	Jet Boat - Telluron
Wave-Induced Boundary Layers in a Stratified	DEVELOPING COUNTRIES	ing Streamflow in I W73-02646
Fluid,	Superdams: The Perils of Progress,	
W73-02761 8B	W73-02850 6G	DISCOUNT RATES
DESALINATION	DEWATERING TO THE PART OF THE	Discount Rates fo Uncertainty,
Desalting as a Source of Water Supply,	Mechanisms of Sludge Thickening,	W73-02942
W73-02861 3A	W73-02948 5D	
Apparatus for the Distillation of Sea Water,	Precont Vacuum Filtration and Natural-Freeze	DISEASE (FISH) Distribution of Re
W73-02985 3A	Dewatering of Alum Sludge,	Used for Fish Bree
Centrifugal, Multieffect Distillation Apparatus,	W73-02965 5F	W73-03109
W73-02986 3A	DIAZINON	DISEASE RESISTAN
Desalting and Purifying Water by Continuous	Metabolism of Diazinon by Fish Liver	Nutrient Status and
Ion Exchange,	Microsomes,	of Water Transport
W73-02998 3A	W73-03167 5C	W73-03087

PLOTE OR OTHER PROPERTY OF THE	DISPERS
DICHLOROHYDRIN	Transp
Process and a Product for the Purification of	Suspen
Polluted Water from Heavy Metal Ions Present	11,
Therein, W73-02992 5D	W73-02
W 15-02552	A Met
DIELDRIN	Tower
A Laboratory Study on the Toxicity of Dieldrin	W73-02
to Fresh Water Invertebrates,	
W73-02695 5C	Gravita
Pyrink	Aquife
DIETS (FISH)	W73-02
Fish of the Kuibyshev Reservoir (In Russian),	
W73-03083	The Te
all means of the leading the second of the leading	W73-02
DIFFUSER PIPES	W /3-04
Hydrodynamic Forces on Diffuser Pipes Due	On the
to Barge Passage,	Equation
W73-03032 8B	W73-02
DIFFUSION	
Diffusion of Thermally Buoyant Water Jets	Project
into a Moving Water Stream,	W73-03
W73-02627 5B	DISPERS
Dose D.C. Russa ver Agricultural Linear	The Te
Some Aspects of Heat and Mass Transfer in	cient in
Porous Media,	W73-02
W73-02823 2F	-
Turbulent Thermal Diffusion of a Slot Jet	DISSOLV
	Removi
Flowing into a Moving Stream, W73-02895 5B	W73-02
W 13-02093	Municip
DIGESTION	Water I
The Effect of pH on Aerobic Sludge Digestion,	W73-03
W73-02897 5D	1252/17
2012 101 201	Nitrate
DIGITAL COMPUTERS	A Study
Application of a Digital Hydrologic Simulation	of Den
Model to an Urbanized Watershed,	face W
W73-02946 2A	Surface
The second secon	Farm Po
DILUTE SUSPENSION	W73-03
Transport Processes of Particles in Dilute	DISSOLV
Suspensions in Turbulent Water Flow - Phase	Maximu
II,	Surface
W73-02605	Connec
DIPTERA	W73-03
Some Ecological Notes on Lotic Dipteran	
Emergence in Prater's Creek, South Carolina,	DISTILLA
W73-03162 SC	Apparat
W 13-03102 3C	W73-029
DIRECT CYCLE REACTORS	Centrifu
Sounding The All-In-One Nuclear Drum.	W73-029
W73-02764 5G	W /3-02
Short stores	DISTRIBU
DISCHARGE COEFFICIENT	The Co
Aeration of Weirs,	Fauna o
W73-03142 8B	W73-026
PARCEL POR SER A COMPANION	DISTRIBU
DISCHARGE MEASUREMENT	Environ
Jet Boat - Tellurometer Technique for Measur-	Plant Co
ing Streamflow in Large Rivers, W73-02646 7B	Grand C
W73-02646 7B	W73-030
DISCOUNT RATES	
Discount Rates for Public Investment Under	Distribu
Uncertainty,	Tabanid
W73-02942 6B	W73-031
	DISTRIBU
DISEASE (FISH)	Cleaning
Distribution of Red Spot Disease in Waters	perience
Used for Fish Breeding (In Russian),	W73-028
W73-03109 5C	200
DISEASE RESISTANCE	DISTRICT
Nutrient Status and Mycorrhizal Enhancement	Cleaning
of Water Transport in Soybean,	perience
W73-03087 3F	W73-028
	1000

DISPERSION	DITHIZONE METHOD	Hydrodynamic Forces on Diffuser Pipes Due
Transport Processes of Particles in Dilute	Determination of Total Mercury in Sludge (In	to Barge Passage,
Suspensions in Turbulent Water Flow - Phase	Japanese),	W73-03032 8B
II, W73-02605 8B	W73-02945 5A	Optimized Geometry for Baffle Blocks in
A Method for Calculating the Size of Cooling	DIVERSIONS Application of a Digital Hydrologic Simulation	Hydraulic Jumps, W73-03036
Tower Plumes, W73-02763 5G	Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed,	DRAG REDUCTION
W/3-02/63	W73-02946 2A	Rotational Stability in Dilute Polymer Solu-
Gravitational and Dispersive Mixing in	DOCUMENTATION	tions,
Aquifers, W73-02791 2F	A Glossary of Coastal Engineering Terms.	W73-02874 2E
REPORTED TO THE PROPERTY OF THE PARTY OF THE	W73-02654 8B	DRAINAGE
The Tensor Character of the Dispersion Coeffi-	Compilation of Water Quality Data and	Contents of Oxygen in Soil Water and CO2 in
cient in Anisotropic Porous Media, W73-02831 2G	Parameters from Kansas Rivers and Streams, W73-02973 5A	Soil Air in Forest Bogs of the Central Ukraini- an Poleste (In Ukranian),
On the Derivation of a Convective-Dispersion	(D)	W73-03091 4A
Equation by Spatial Averaging,	DOMESTIC WASTES	DRAINAGE ENGINEERING
W73-02832 2F	Agricultural Wastes in Arid Zones, W73-03128 5F	Slotted Corrugated Metal Pipe Drains,
Project Foggy Cloud III, Phase 1,	W/3-03126	W73-02659 8A
W73-03145 3B	Discussion of Waste Disposal in Arid Lands,	DRAINAGE PATTERNS (GEOLOGIC)
	W73-03129 5F	Patterns of Drainage Areas With Random
DISPERSION TENSORS The Tensor Character of the Dispersion Coeffi-	DOSE PREDICTIONS	Topology,
cient in Anisotropic Porous Media,	Environmental Radiation Dosimetry Near	W73-03075 4A
W73-02831 . 2G	Large Nuclear Power Stations,	Two Models for Horton's Law of Stream Num-
DISSOLVED OXYGEN	W73-02742 5B	bers,
Removal of Dissolved Oxygen from Water,	DOSIMETRY	W73-03079 4A
W73-02988 5D	Environmental Sampling for River Sediments	DRAINAGE SYSTEMS
**	Around a Nuclear Power Station,	Man and Water: A Lesson in History,
Municipal and Industrial Waste with Limited Water Resources.	W73-02740 5B	W73-03090 3F
W73-03127 5F	DOUBLE-CURVATURE ARCH DAMS	NB 4 NIC
We at the state of	Comparison of Analytical and Structural	DRAINS Slotted Corrugated Metal Pipe Drains,
Nitrate Transformations in Surface Waters; 1. A Study of Various Factors Affecting the Rates	Behavior Results for Morrow Point Dam,	W73-02659 8A
of Denitrification and Immobilization in Sur-	W73-02847 8A	
face Waters, and II. Characterization of the	DRAG	DRAWDOWN
Surface Waters in the Wabash River and Three	Rotational Stability in Dilute Polymer Solu-	The Reciprocity Principle in Flow Through Heterogeneous Porous Media,
Farm Ponds, W73-03191 5B	tions,	W73-02827 4E
W73-03191 3B	W73-02874 2E	
DISSOLVED SOLIDS	Experimental Investigation of Effects of Un-	Effect of Reservoir Drawdown on Optimal Operation,
Maximum Concentration of Dissolved solids in	steady Flows on a Submerged Cylinder,	W73-03244 4A
Surface Water, Hartford North Quadrangle, Connecticut.	W73-03019 8B	
W73-03155 7C	Loss of Pressure Due to Periodic Movement of	DREDGING
	an Obstacle (Sur la perte de charge due a un	Fall River Harbor, Massachusetts and Rhode Island (Draft Environmental Impact State
DISTILLATION Apparatus for the Distillation of Sea Water,	obstacle en mouvement periodique),	ment).
W73-02985	W73-03020 8B	W73-03144 8A
	Forces Due to Cylinders Falling Through Water	Milwankee Diked Disposal Area Wisconsin
Centrifugal, Multieffect Distillation Apparatus,	in a Vertical Tube,	Milwaukee Diked Disposal Area, Wisconsin (Draft Environmental Impact Statement).
W73-02986 3A	W73-03021 8B	W73-03151 5G
DISTRIBUTION	Flow-Induced Dynamic Pressures on Square-	DREDGING DISPOSAL
The Composition and Distribution of the Fish	Section Cylinders,	Milwaukee Diked Disposal Area, Wisconsin.
Fauna of the Navasota River, W73-02613	W73-03022 8B	(Draft Environmental Impact Statement).
W73-02813	and the same of th	W73-03151 5G
DISTRIBUTION PATTERNS	Drag Coefficient and Turbulence Charac- teristics,	DRINKING WATER QUALITY
Environmental Influence on the Pattern of Plant Communities Along the North Rim of the	W73-03023 8B	Bioassays of Quality in Water Resources of
Grand Canyon,	The state of the s	Major Importance to New Mexico,
W73-03078 2I	Wake Dynamics of Two-Dimensional Struc-	W73-02876 50
Distribution and Second Occurred of	tures in Confined Flows, W73-03024 8B	DROPS (FLUIDS)
Distribution and Seasonal Occurrence of Tabanidae along a Transect of South Carolina,	W 73-03024	Project Fog Drops. Part 1: Investigations of
W73-03156 5B	The Frequency of Oscillating Forces Acting on	Warm Fog Properties,
BIOTRIPION CUCTEMO	Bluff Cylinders in Constricted Passages,	W73-02782
DISTRIBUTION SYSTEMS Cleaning Water Mains With Foam PlugsEx-	W73-03025 8B	DROUGHT
perience at Washington, D. C.,	Amplitude-Dependent Frequency of An Oscil-	The Effect of Drought on Potato Yields in the
W73-02862 5G	lating Cylinder in a High-Velocity Flow,	Ukrainian SSR (In Russian),
DISTRICT OF COLUMBIA	W73-03026	W73-02690 31
Cleaning Water Mains With Foam Plugs-Ex-	Accelerated Motion of a Sphere in an Oscillat-	Effect of an Asphalt Barrier on Water Redis
perience at Washington, D. C.,	ing Fluid,	tribution after Infiltration in Sandy Soils,

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3F

Environ Dischar from Ul W73-032

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W73-026
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W73-026

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W73-0286
EMULSION
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W73-0299
ENGINEER
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W73-0313
ENTERIC E
Antibodie
Brown
Leseuer)
W73-0297

Radioactiv Atlantic O W73-02710

> West Vali tal Report W73-02712

Annual R Radiation W73-02744

DROUGHT RESISTANCE

Drought Resistance and Internal Water Balance	An Economic Analysis of Water-Use Regula-	Application of a Digital Hydrologic Simulati	ioz
of Oak Seedlings,	tion in the Central Ogallala Formation,	Model to an Urbanized Watershed,	N/S
W73-03199 2D	W73-02892 4B		2.4
DROUGHT TOLERANCE Early Growth and Development of Slash Pine	A New Theory of Pricing and Decision-Making for Public Investment,	EFFICIENCY GUARANTEES A New Approach to Efficiency Guarantees,	
Under Drought and Flooding,	W73-02917 6B	W73-02842	80
W73-03207 4A	On the Possibility of a Market for Externalities,	EFFLUENT	
DRY ICE	W73-02933 6B	Physico-Chemical Limnology and Periphytor	in
Freezing Oil Spills,	Current Novales and Mark No. 5, Novales and A. S.	a Warm-Water Stream Receiving Wastews	
W73-03013 5G	Taxation and PollutionSome Comments, W73-02935 5G	Treatment Plant Effluent,	5D
DRY RAVEL	Passania Pilisianan Va Fauironmental Onali		
Erosional Consequences of Timber Harvesting:	Economic Efficiency Vs. Environmental Quali- ty in Small Watershed Development,	Assimilation of a Wastewater Treatment Pl	
An Appraisal, W73-02957 2J	W73-02936 4D	Effluent by the Asa Creek-Kaskaskia Ri System, Moultrie County, Illinois,	
DYNAMIC PROGRAMMING	Agricultural Wastes in Arid Zones,	W73-02887	5C
Multireservoir Analysis Techniques in Water	W73-03128 5F	EFFLUENT CHARGES	
Quantity Studies,	ECONOMIC IMPACT	Systems Analysis and Water Quality Mana	ge-
W73-02664 4A	A Water Supply-Demand Analysis in Clinton	ment,	ī
Integrated Management of Quantity and Quali-	County, Pennsylvania: A Study in Economic Hydrology.	W73-02943	50
ty of Urban Water Resources,	W73-02610 6D	EFFLUENTS	
W73-02666 5G	TOTAL AND STATE OF THE PARTY OF	Environmental Monitoring Report: Ju	ily.
Systems Approaches to Microscale Problems of Water Pollution Control,	Aggregate Returns from Water Resource Development in Georgia, 1946-1965,	December 1971 and 1971 Summary, W73-02709	5B
W73-03223 5G	W73-02919 6B	Environmental Monitoring in the Vicinity	
L COLI	An Economic Inventory of the Miami River	the Los Alamos Scientific Laboratory, J	uly
The Antibacterial Capabilities of	and Its Economic and Environmental Role in	through December 1971. W73-02719	SP
Polyhalogenated Ion Exchange Resins, W73-03187 5F	Biscayne Bay, W73-02923 4A	- No. Section 18 - 19 April 19	-
	THE RESIDENCE OF THE PARTY OF T	Proceedings of Southern Conference on Vironmental Radiation Protection from Nucl	
EARTH DAMS	The General Economy. W73-02929 5G	Power Plants, April 21-22, 1971.	Cat
Examples of the Internal Condtions of Some	W 13-02929	W73-02732	SE
Old Earth Dams, W73-02841 8A	Economic Impact of Anticipated Paper Indus-	at the state of the second and	
W 15-02041	try PollutionAbatement Costs, Part I: Execu-	Evaluation of Environmental Factors Affect	ing
Stresses and Movements in Oroville Dam,	tive Summary. W73-02941 5G	Population Exposure, W73-02733	5B
W73-02849 8D	W 73-02941	# 13-0£133	35
Internal Piping and Shear Deformation Victor	U. S. Deepwater Port StudyThe Environmen-	Waste Management,	
Braunig Dam - San Antonio, Texas,	tal and Ecological Aspects of Deepwater Ports. W73-03136 8A	W73-02734	5B
W73-03250 8D	#15-03130	The Terrestrial Radiological Monitoring I	ro
EARTH-MUSTY ODOR	ECONOMIC INVENTORY	grams at Duke Power Company's Oconee	and
Production of Geosmin and 2-Exo-Hydroxy-2-	An Economic Inventory of the Miami River	McGuire Nuclear Stations,	-
Methylbornane by Streptomyces odorifer,	and Its Economic and Environmental Role in Biscayne Bay,	W73-02735	31
W73-02949 5A	W73-02923 4A	Aquatic Radiological Monitoring Browns Fe	III
ECOLOGY		Nuclear Plant,	
Superdams: The Perils of Progress,	ECONOMIC TRADE-OFFS	W73-02736	5E
W73-02850 6G	Integrated Management of Quantity and Quali-	An Ecological Approach to Marine Padiol	aai
Water for Toyon	ty of Urban Water Resources, W73-02666 5G	An Ecological Approach to Marine Radiol cal Monitoring At the Florida Power Corpo	
Water for Texas. W73-03066 5B	The second secon	tion Crystal River Nuclear Plant,	
W12-53000	ECONOMICS	W73-02737	51
The Impact of Water Development on the	Development of Water Resources of a Basin	Environmental Complian for Diver Calling	
Ecology of River Systems,	Taking Economic Aspects into Account: Pecu- liarities of Investigation of Practical Irrigation	Environmental Sampling for River Sedime Around a Nuclear Power Station,	-
W73-03068 5B	Problems,	W73-02740	5E
The Impact of Water Development on the	W73-03226 3F		0
Ecology of Bays and Estuaries,	POONOMIES OF SOLUE	Environmental Radioactivity Measurement	Ex
W73-03069 5B	ECONOMIES OF SCALE A Branch-And-Bound Algorithm for Regional	perience Near a Fuels Reprocessing Plant, W73-02741	SE.
The Impact of Water Development on Ecology	Water Quality Management,	to the selection between the selection	31
of the Gulf of Mexico,	W73-03243 5G	Environmental Radiation Dosimetry N	ea
W73-03070 5B	EDDY DIFFUSION	Large Nuclear Power Stations, W73-02742	gy.
ECONOMIC BASE ANALYSIS	Eddy Diffusion Coefficients due to Instabilities	W73-02742	5E
Comprehensive Survey of Elk River Basin,	in Internal Gravity Waves,	Radioactive and Stable Nuclides in the Col	um
Volume II, Economic Base Study,	W73-02776 2E	bia River and Adjacent Northeast Pac	
W73-02860 6D		Ocean,	-
ECONOMIC DEVELOPMENT	EDUCATION The River Basin Model: The Social Science	W73-02745	51
Village Technology Handbook.	Laboratory.	Pollution Policy.	
W73-02922 8A	W73-02853 6B	W73-02959	50
Marie and Marie		MANAGEMENT OF THE PARTY OF THE	

Ecology of River Systems, W73-03068

5B

SB

5B

		ENVRIONMENTAL EFFECTS
NVIRONMENTAL CONTROL		The Impact of Water Development on the
The Transfer of Water Research Output by Environmental Protection Agency,	the	Ecology of Bays and Estuaries, W73-03069 5B
W73-02879	6B	The Impact of Water Development on Ecology
A Plastic Inflated Environmental Gro	wth	of the Gulf of Mexico,
Chamber, W73-03095	3F	W73-03070 5B
An Integrated System for Providing Pow Water and Food for Desert Coasts, W73-03099	ver,	Environmental Influence on the Pattern of Plant Communities Along the North Rim of the Grand Canyon, W73-03078
		STATE AND PERSON AS NOT THE REAL PROPERTY.
Vegetable Production Under Plastic on Desert Seacoast of Abu Dhabi, W73-03110	3F	Interaction of Temperature and Salinity on Sugar Beet Germination, W73-03084 3C
INVIRONMENTAL EFFECTS		A Plastic Inflated Environmental Growth
The Nature and Extent of Peat Deposits Possible Effects of Peat Mining on Manm		Chamber, W73-03095 3F
Features and Springs Near Mescalero, N		and the same of th
Mexico, W73-02661	4B	Health Related Problems in Arid Lands. W73-03126 SF
Tritium and Its Effects in the Environment		Agricultural Wastes in Arid Zones,
Selected Literature Survey.	- ^	W73-03128 5F
W73-02720	5C	U. S. Deepwater Port StudyThe Environmen-
RU106 Distribution in a Reduced Model Si- lating River Banks; Some Hydrodynamic	and	tal and Ecological Aspects of Deepwater Ports. W73-03136 8A
Kinetic Aspects of Its Adsorption on S ments (Repartition Du RU106 Dans Un Mod Reduit Simulant Les Berges D'Une Rivi ere	dele),	A Survey of Some Possible Effects of Logging on Two Eastern Vancouver Island Streams,
W73-02724	5B	W73-03160 4C
Progress Report, Biology and Health Phy Division, Environmental Research Bran January 1972 to March 31, 1972,	nch,	Round Table Meetings on the Deterioration of the Environment; Conference (In Spanish). W73-03195 6G
W73-02725	5C	ENVIRONMENTAL ENGINEERING
Evaluation of Environmental Factors Affect Population Exposure, W73-02733	ting 5B	A Plastic Inflated Environmental Growth Chamber, W73-03095
	345	20,000
Biological Effects of Air Pollution, W73-02773	5C	ENVIRONMENTAL IMPACT STATEMENTS Radioactive Waste Repository, Lyons, Kansas,
Environmental Benefit-Cost Analysis	for	(Final Environmental Impact Statement). W73-02721 5C
Nuclear Power Generation, W73-02840	6B	Flood Control at Muscatine, Iowa (Final En-
Petroleum Hydrocarbons and the Sea,		vironmental Impact Statement). W73-03017 4A
W73-02866	5C	Fall River Harbor, Massachusetts and Rhode
The Relationship Between Land Use and vironmental Protection, W73-02915		Island (Draft Environmental Impact State- ment).
	4A	W73-03144 8A
An Economic Inventory of the Miami R and Its Economic and Environmental Rol Biscayne Bay,		Milwaukee Diked Disposal Area, Wisconsin, (Draft Environmental Impact Statement).
W73-02923	4A	W73-03151 5G
Literature Review: Economics, W73-02934	5G	ENVIRONMENTAL POLLUTION A Mobile Laboratory for Monitoring Environ-
Economic Efficiency Vs. Environmental Qu	uali-	mental Pollution (In Italian), W73-03108 5A
ty in Small Watershed Development, W73-02936	4D	ENVIRONMENTAL PROTECTION AGENCY EPA, Environmental Legislation and Energy,
Flood Control at Muscatine, Iowa (Final	En-	W73-02739 SG
vironmental Impact Statement). W73-03017	4A	The Transfer of Water Research Output by the
Water for Texas.		Environmental Protection Agency, W73-02879 6B
W73-03066	5B	ENVRIONMENTAL EFFECTS
The Impact of Water Development on	the	Scrubbed Diesel Exhaust for Carbon Dioxide
Ecology of River Systems,	4B	Enrichment of Greenhouse Vegetables, W73.03074

ENVRIONMENTAL EFFECTS

Environmental Monitoring Associated with	ENVIRONMENTAL CONTROL
Discharges of Radioactive Waste During 1969	The Transfer of Water Research Output by the
from UKAEA Establishments.	Environmental Protection Agency,
W73-03220 5B	W73-02879
ELECTRIC POWER	A Plastic Inflated Environmental Grow
Electrical Energy Needs and Environmental	Chamber.
Problems, Now and in the Future.	W73-03095
W73-02768 5C	Min arona market
ELECTRIC POWER DEMAND	An Integrated System for Providing Power
Electrical Energy, Demand and Supply,	Water and Food for Desert Coasts, W73-03099
W73-02769 SC	W/3-03099
#15-02105 SC	Vegetable Production Under Plastic on the
ELECTRIC POWER PRODUCTION	· Desert Seacoast of Abu Dhabi,
Electrical Energy, Demand and Supply,	W73-03110
W73-02769 5C	
ELECTRICAL STUDIES	ENVIRONMENTAL EFFECTS
On the Correlation of Electrical Conductivity	The Nature and Extent of Peat Deposits a
Properties of Porous Systems with Viscous	Possible Effects of Peat Mining on Manma
Flow Transport Coefficients,	Features and Springs Near Mescalero, Ne Mexico.
W73-02822 2F	W73-02661
Amount of the state of the stat	
ELECTRICAL WELL LOGGING	Tritium and Its Effects in the Environment -
On the Correlation of Electrical Conductivity	Selected Literature Survey.
Properties of Porous Systems with Viscous Flow Transport Coefficients,	W73-02720
W73-02822. 2F	RU106 Distribution in a Reduced Model Sim
475-02022	lating River Banks; Some Hydrodynamic a
ELECTRON MICROSCOPY	Kinetic Aspects of Its Adsorption on Sec
Effects of Salt Treatments of Cotton Plants	ments (Repartition Du RU106 Dans Un Mode
(Gossypium hirsutum L.) on Leaf Mesophyll	Reduit Simulant Les Berges D'Une Rivi ere),
Cell Microstructure,	W73-02724
W73-03081 3C	to the first of the first of the second of the second of
ELEOCHARIS ACICULARIS	Progress Report, Biology and Health Physi
The Use of Aquatic Plants in the Rehabilitation	Division, Environmental Research Branc
of Acid Polluted Streams,	January 1972 to March 31, 1972, W73-02725
W73-02611 5G	W 13-02123
Charles Calendary Free Land Committee of 111	Evaluation of Environmental Factors Affecti
ELEOCHARIS ACICULARIS M	Population Exposure,
The Association of Littorella Uniflora and	W73-02733
Eleocharis Acicularis in the 'Entre-Sambre-Et-	Minimum and Alexander
Meuse,' W73-02691 2I	Biological Effects of Air Pollution, W73-02773
#13-02051	W 13-02113
ELK RIVER BASIN (W VA)	Environmental Benefit-Cost Analysis
Comprehensive Survey of Elk River Basin,	Nuclear Power Generation,
Volume II, Economic Base Study,	W73-02840
W73-02860 6D	
EMULSIONS	Petroleum Hydrocarbons and the Sea,
The Vertical Movement of Oil in Seawater and	W73-02866
the Aging of Oil Slicks,	The Relationship Between Land Use and E
W73-02904 5G	vironmental Protection,
117-02704	W73-02915
ENGINEERING STRUCTURES	
U. S. Deepwater Port Study-The Environmen-	An Economic Inventory of the Miami Riv
tal and Ecological Aspects of Deepwater Ports.	and Its Economic and Environmental Role
W73-03136 8A	Biscayne Bay,
ENTERIC BACTERIA	W73-02923
Antibodies Against Human Enteric Bacteria in	Literature Review: Economics,
Brown Bullheads (Ictalurus Nebulosus,	W73-02934
Leseuer) from Contaminated Waters,	
W73-02975 5C	Economic Efficiency Vs. Environmental Qua
DENIES OF PROPERTY.	ty in Small Watershed Development,
ENVIRONMENT	W73-02936
Radioactivity of Waters in Northeastern Part of	Flood Control at Muscatine, Iowa (Final I
Atlantic Ocean.	The Course of Management town (1,199) T

B

fic

5B

5G

W73-02710

W73-02712

W73-02744

West Valley Reprocessing Plant. Environmental Report No. 11, 2nd Half 1971,

Annual Report of the Eastern Environmental

Radiation Laboratory, January-December 1970.

ENZYMES		

ENTINES WINDSHOWAND		
ENZYMES Provision Circulian Oscillations in Enzyme	Columbia River Effects in the Northeast	On the Possibility of a Market for Externalities,
Persisting Circadian Oscillations in Enzyme Activity in Non-Dividing Cultures of Euglena,	Progress Report, Sept. 1971 to May 1972.	W73-02933
W73-02969 5C	W73-02751 5B	EXTRA HIGH VOLTAGE
The french of Water Downsonment on Reclaim		Transmission Goals: Maximum Rating With
Organochlorine Insecticide, Herbicide and Polychlorinated Biphenyl (PCB) Inhibition of	Trace-Metal Associations in Sub-Artic and Arc- tic Marine Environments - Progress Report,	Minimum Environmental Impact,
Nakatpase in Rainbow Trout,	June 1971-May 1972,	W73-02843
W73-03165 5C	W73-02754 5B	EXUDATION
A through the A foot and A and A foot and A foot		Sodium Export From Bean Leaves as Affected
EPICHLOROHYDRIN Process and a Product for the Purification of	EUGLENA Persisting Circadian Oscillations in Enzyme	by the Mode of Application,
Polluted Water from Heavy Metal Ions Present	Activity in Non-Dividing Cultures of Euglena,	W73-03073
Therein,	W73-02969 5C	PALL BIVER HARBON WASS AND D. 11
W73-02992 5D		FALL RIVER HARBOR (MASS AND R. L.) Fall River Harbor, Massachusetts and Rhode
EPIPHYSIS *	Effects of Streptomycin on the Ultrastructure of Plastids in Euglena,	Island (Draft Environmental Impact State-
An Epidemiological Study of the Effect of	W73-02972 5C	ment).
Fluorides in Drinking Water on the Frequency	A commence of the Arthur Arthur and the Arthur	W73-03144
of Slipped Capital Femoral Epiphysis,	EUGLENOPHYTA	FALLOUT
W73-03071 5F	Surface Phytoplankton and Some Aspects of	Results of Environmental Radioactivity Mea-
EPOXIDIZED BLACK LIQUOR	the Physical-Chemical Limnology of Three Areas on Lake Texoma,	surements in the Community Countries in 1970:
Process and a Product for the Purification of	W73-03072 2H	Air-Fallout-Water (Messwerte der Umwel-
Polluted Water from Heavy Metal Ions Present		tradioaktivitat in den Landern der
Therein, W73-02992 5D	Electrical Factor Needs and Environmental	Gemeinschaft im Jahre 1970: Luft
W73-02992 5D	Electrical Energy Needs and Environmental Problems, Now and in the Future.	Niederschlage-Wasser).
EQUATIONS	W73-02768 5C	W73-02726
Predicting sediment yield in Western United	- Intelligence of a manufacture of the	FARM WASTES
States,	EUTROPHIC IMPOUNDMENTS	Agricultural Wastes in Arid Zones,
W73-02795 2J	Thermal Stratification and Thermocline Control in Storage Reservoirs,	W73-03128 SF
EQUILIBRIUM	W73-02777 5B	The original handed 1.7 on LeafWilliams
On the Equilibrium of a Cable Connected to a		FECAL GERMS
Free-Floating Body Placed in a Stream,	Control of Thermal Stratification in Thames	Study of the Pollution of the Lagoon at Tahit
W73-03062 8B	Valley Reservoirs, W73-02778 5B	by Fecal Germs (In French), W73-03181
EROSION	The standard of the standard o	The Use of Asyntic Place to the Registration
Mechanism of the Formation of Some 'Ter-	EUTROPHICATION	FEDERAL GOVERNMENT
minal Moraines' and Role of Water in Glacial	Sources of Nutrients in Canadarago Lake,	The Importance of a Practical Research Inpu
Erosion (Mekhanizm obrazovaniya nekotorykh 'konechnykh moren' i rol' vodnoy erozii v	W73-02859 5C	to Water Resources Development,
dinamike lednika),	EVAPORATION	W73-02878
W73-02642 2C	An Expansion Cloud Chamber Study of Water	The Transfer of Water Research Output by the
Desdission andiment of the Window W. t. A.	Evaporation,	Environmental Protection Agency,
Predicting sediment yield in Western United States.	W73-02890 2B	W73-02879 6B
W73-02795 2J	Sewage Treatment System,	FEDERAL PROJECT POLICY
	W73-02983 5D	FWQA Sets Rules for Sewage Treatment Plan
Pediments and Terraces along the Moapa Val-	Contributed Multiseffeet Distillation Assessment	Design.
ley, Clark County, Nevada, W73-03146 2J	Centrifugal, Multieffect Distillation Apparatus, W73-02986 3A	W73-02958 5D
475-03140	H 13-02500	Property Control
ESCAMBIA BAY (FLA)	EVAPORATION RETARDANTS	Pollution Hearing Sets a Southern Landmark.
Pollution Hearing Sets a Southern Landmark.	An Expansion Cloud Chamber Study of Water	W73-02960 50
W73-02960 5G	Evaporation,	Engineers Score Federal Pollution Tactics.
ESTUARIES	W73-02890 2B	W73-02961 50
The Impact of Water Development on the	EVOLUTION	Market Company of the
Ecology of Bays and Estuaries,	Reduction of Oil Spills During Shipboard Fuel	FEDERAL-STATE WATER RIGHTS
W73-03069 5B	Movement Evolutions,	CONFLICTS Columbia Biver Interstate Compact Politics of
Programming Model of Regional Water Quality	W73-02907 5G	Columbia River Interstate Compact, Politics on Negotiation,
Management,	EXPANSION CLOUD CHAMBER	W72.02614
W73-03240 5G	An Expansion Cloud Chamber Study of Water	at integral constitution in the constitution in the
ESTUARINE ENVIRONMENT	Evaporation,	FEED (COWS)
Uptake of Ru106 by Marine Organisms in	W73-02890 2B	Biological Background of High-Productiv
Aquaria and in the Natural Environment (Ob-	EXPANSIVE SOILS	Pastures and the Quality of the Feed (In Russian)
servations Concernant les Contaminations Ex-	Hydrostatics and Hydrodynamics in Swelling	sian), W73-03180
perimentales et les Contaminations 'In situ'	Media, W73-02837	The state of the s
D'especes Marines Par Le Ru106, W73-02717 5B	W73-02837 2G	FEEDING HABITS (FISH)
3B	EXTERNAL FRICTION COEFFICIENT	Feeding Rhythm of Sturgeon in the Volgogra
Insoluble Species and Polymerization of	External Friction Coefficient of Sierozem (In	Reservoir, (In Russian),
Nitrato Complexes of Nitrosylruthenium in Sea	Russian),	W73-02685
Water (Nouvelles Etudes Sur Les Formes In- solubles Et Sur Les Phenomenes De	W73-03213 2G	FERN P
solubles Et Sur Les Phenomenes De Polymerisation Des Nitratocomplexes Du	EXTERNALITIES	A Southern Outpost of Steppe Ravine Forest in
Nitrosylrut henium En Eau De Mer),	Pollution: Taxation or Purification,	Semi Desert, (In Russian),
W72 02721 ED	W73.03011 SD	W73.02758

ith IC

21

A

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B

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D

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81

A

FERROUS IRON	Commercial Shrimp FarmingNearing Reali-	FLOCCULATION
Neutralization of Ferrous Iron-Containing Acid	ty,	Chemical and Physical Factors in the Floccula-
Wastes, W73-02995 5D	W73-02932 3E	tion of Metal Plating Wastes with Polyelec-
	FISH LIVER	trolytes, W73-02626 5D
PERTILIZERS	Metabolism of Diazinon by Fish Liver Microsomes,	of market maker distil to enterious, u.s.
Hydrochemical Regime of Ponds Fertilized with Complex Concentrated Forms of Fertil-	W73-03167 5C	Process for Removing Contaminants from Waste-Water.
izer.	Expenses of the Powers McOdiff of the	W73-03003 5D
W73-02728 8I	FISH MORPHOLOGY	within the series and the state of the series of the serie
Fertilizer and Methods of Preparing the Soil in	The Biology of a Landlocked Form of the Nor- mally Catadromous Salmoniform Fish Galaxias	FLOOD CONTROL
Carp Breeding Ponds, (In Russian),	Maculatus (Jenyns): II. Morphology and Syste-	Flood Control Storage Allocations by Linear
W73-02749 8I	matic Relationships,	Programming, W73-02667 4A
The second secon	W73-02856 2I	175-02007
The Containment and Recovery of Navy Oil	FISH POPULATIONS	Probability of Exceeding Capacity of Flood-
Spills-A Financial Analysis,	The Composition and Distribution of the Fish	Control System at the National Reactor Testing Station, Idaho.
W73-02909 5G	Fauna of the Navasota River,	W73-02781 4A
	W73-02613 8I	The American Company Company of the State of Management of the Company of the Com
Fine Structure of Swarmers of Cladophora and	FISH REARING	Flood Control Method and Apparatus,
Chaetomorpha. III. Wall Synthesis and	Hydrochemical Regime of Ponds Fertilized	W73-03010 4A
Development,	with Complex Concentrated Forms of Fertil-	Flood Control at Muscatine, Iowa (Final En-
W73-02966 5C	izer,	vironmental Impact Statement).
FINITE ELEMENT ANALYSIS	W73-02728 81	W73-03017 4A
Stresses and Movements in Oroville Dam.	FISH REPRODUCTION	FLOOD DAMAGE
W73-02849 8D	Successful Spawning of Largemouth Bass,	Flood Profiles in the Umpqua River Basin,
	Micorpterus salmoides (Lacepede) Under	Oregon, Part I,
General Purpose Program of Plane Stress Anal- vsis by Finite Element Method, and its Appli-	Laboratory Conditions, W73-02953 5G	W73-02660 7C
ysis by Finite Element Method, and its Appli-	and the state of t	A Computer Simulation Model for Flood Plain
W73-02852 8A	FISHERY MANAGEMENT	Development, Part 1: Land Use Planning and
man and	Nitrogen Compound Regime in the Water and	Benefit Evaluation,
On the Phytoplankton of Waters Polluted by a	Soil of Ponds, (In Russian), W73-02756 81	W73-02944 4A
Sulphite Cellulose Factory,		EL COD DATA
W73-02979 5C	FISHING	FLOOD DATA Flood Control at Muscatine, Iowa (Final En-
Market Company of the	Multi-Disciplinary Study of Water Quality Relationships: A Case Study of Yaquina Bay,	vironmental Impact Statement).
Effluent and Water Quality Control of a Synthetic Fiber Pulp Mill (Abwasser Und	Oregon,	W73-03017 4A
Gewaesserschutz Einer Kunstfaserzelistof-	W73-02921 5C	FLOOD MEASUREMENT
(abrik),	and the second of the second o	Water Resources Data for Georgia-1971.
W73-03157 5D	FIXED COSTS Catfish Production in Southeastern Arkansas:	W73-02784 7C
FIRE PROTECTION	Estimated Investment Requirements, Costs,	
A Businesslike Approach to Fire Prtoection	and Returns, for Two Sizes of Farms,	FLOOD PLAIN ZONING
Charges.	W73-02926 3E	A Method of Comparing Forest Production Data to Agricultural Data in River Basin
W73-02864 3D	FJORDS	Planning.
FIRE SAFETY	Trace-Metal Associations in Sub-Artic and Arc-	W73-03093 6F
A Businesslike Approach to Fire Prtoection	tic Marine Environments - Progress Report,	and the second section of the second
Charges.	June 1971-May 1972,	FLOOD PLAINS Flood Profiles in the Umpqua River Basin,
W73-02864 3D	W73-02754 5B	Oregon, Part I,
PISH	FLAP GATES	W73-02660 7C
Temperature Sensitivity of Two Species of In-	Theoretical Study on Flap Gate Oscillation,	4 C
tertidal Fishes,	W73-03044 8B	A Computer Simulation Model for Flood Plain Development, Part 1: Land Use Planning and
W73-02762 5C	FLASH DISTILLATION	Benefit Evaluation,
FISH DISEASES	Apparatus for the Distillation of Sea Water,	W73-02944 4A
Changes in the Peripheral Blood in Carp	W73-02985 3A	FLOOD ROUTING
(Cyprinus Carpio L.) Under the Influence of	FLASH EVAPORATION	Probability of Exceeding Capacity of Flood-
Ammonium Liquor (Zmiany we Krwi Ob-	Identification of Toxic Components in Oil	Control System at the National Reactor Testing
wodowej Karpis (Cyprinus Carpio L.) Pod Wplywem Wody Amoniakalnesi,	Refinery Effluents and Determination of Their	Station, Idaho,
W73-03158 5C	Effect Upon the Aquatic Biota, W73-02609 5A	W73-02781 4A
		FLOODING
Fifests of Mudaness Sulfide on Fish Foot and	FLIES	Early Growth and Development of Slash Pine
Effects of Hydrogen Sulfide on Fish Eggs and Fry,	Distribution and Seasonal Occurrence of Tabanidae along a Transect of South Carolina,	Under Drought and Flooding,
W73-03164 5C	W73-03156 5B	W73-03207 4A
	Street, of the Delicate Uniques of the Visco-	FLOODPLAINS
FISH FARMING	FLOATING	Flood Plain Vegetation of the Middle Regions
Net A Profit From Farm Fish Crop, W73-02924 3E	On the Equilibrium of a Cable Connected to a Free-Floating Body Placed in a Stream,	of the Kerulen River (From Information of the
	W73-03062 8B	Joint Soviet-Mongolian Complex Biological Ex-
Catfish Production in Southeastern Arkansas:		pedition of the Academy of Science of the
Estimated Investment Requirements, Costs, and Returns, for Two Sizes of Farms,	FLOATING ICE Stability of Floating Ice Blocks,	USSR and the Academy of Science of the MP R. (In Russian),
W73-02926 3E	W73-02792 2C	W73-02882 21
	A STATE OF THE STA	

Projec W73-0

FOG SEI Projec W73-0

FOOD C Uptake Aquari servati perime D'espe W73-0

Sympo Protect W73-02

Enviro W73-02

FOODS Effecti Mixtur W73-07

FORECA Energy Prelimi W73-02

Compre Volume W73-02

A Com Develo Benefit W73-02

A Meti Irrigate in Seas W73-03

Great Aid, W73-03

Peculia Compo W73-02

PORESTS Dynami River I Shore, W73-02

FOULING Fouling Heat Ti W73-02

FOULING Fouling Heat Tr W73-02

Specific Rocks, W73-020 On the l tured Po W73-020

LOODS Flood Profiles in the Umpqua River Basin, Oregon, Part I,	The Frequency of Oscillating Forces Acting on Bluff Cylinders in Constricted Passages, W73-03025 8B	Hydrodynamic Forces Acting on Sonic Oscilla- tors in Sonic Transmissions (Forces hydrodynamiques agissant sur les oscillateurs
W73-02660 • 7C	Amplitude-Dependent Frequency of An Oscil-	soniques prevus dans les transmissions soniques),
An Application of Multi-variate Analysis in Hydrology,	lating Cylinder in a High-Velocity Flow, W73-03026 8B	W73-03056 8B
W73-02873 2E	Extension of the Flow-Net Method to Un-	FLOW AUGMENTATION
Flood Hydrographs for Ungaged Streams, W73-02880 2E	steady Internal and External Flows, W73-03027 8B	Modeling Discharge and Conservative Water Quality in the Lower Kansas River Basin, W73-02658 4A
Map Showing Drainage Basins and Historic	Accelerated Motion of a Sphere in an Oscillat-	Benefits of Flow Augmentation for Water
Cloudburst Floods in the Salina Quadrangle, Utah,	ing Fluid, W73-03028 8B	Quality Control,
W73-03152 7C	Moment Characteristics of Cascades Under	And Sale Street, made to delicate the second second second
LORIDA Pollution Hearing Sets a Southern Landmark.	Nonstationary Flow Conditions, W73-03029	FLOW MEASUREMENT Measurements of Turbulence in Water at High
W73-02960 5G	Calculation of Generalized Hydrodynamic	Velocity, W73-02790 2E
New Attitudes About Legal Protection for	Forces for Kaplan Turbine Blades Oscillating	Cold Life Cold Cold Cold Cold Cold Cold Cold Cold
Remains of Florida's Natural Environment, W73-03216 6E	in the Liquid Flow, W73-03030	FLOW NETS Extension of the Flow-Net Method to Un-
	Hydrodynamic Forces Due to Nonstationary	steady Internal and External Flows,
LOTATION Anaerobic Treatment of Starch Wastewaters,	Oscillations of Cylindrical Shells in a Fluid	W73-03027 8B
W73-02619 5D	Medium with Deformations of the Cross-Sec- tion Taken into Account,	FLOW RATES The Warwickshire Avon: A Case Study of
LOTSAM	W73-03047 8B	Water Demands and Water Availability in an
Multichamber Floating Barrier, W73-03015 5G	Natural Vibrations of Cylindrical Shells in a	Intensively Used River System, W73-03103 6D
Trajectory of Floating Bodies in a Strongly	Moving Fluid (Vibrations propres de coques cylindriques en presence de fluide),	PLUID FRICTION
Deviating Fluid Vein, (Trajectoire de corps	W73-03048 8B	Friction Forces of Unsteady Flows in Open
flottants dans une veine fluide fortement device).	On Hydroelastic Correlations Between Dif-	Channels and Pipes, W73-03041 8B
W73-03035 8B	ferent Forms of Oscillations of Plate in the Flow Boundary Resulting from Non-Uniform	Telefolia Cartolica Faccionio secono sentireta
LOW	Distribution of Averaged Flow Velocity in	FLUID MECHANICS Approximate Calculation of a Thermally
Dynamics and Structure of the Yuzhnyy In- yl'chek Glacier (Voprosy dinamiki i struktury	Depth, W73-03049 8B	Stratified Turbulent Boundary Layer in a Re- gion Downstream. A Sharp Change in the
lednika Yuzhnyy Inyl'chek), W73-02639 2C	Investigation of Nonstationary Hydrodynamic Forces Induced by a Plate Oscillating in Liquid	Roughness of the Surface at Which Flow Takes Place,
Approximate Calculation of a Thermally	Flow (Two-Dimensional Problem),	W73-03058 8B
Stratified Turbulent Boundary Layer in a Re- gion Downstream. A Sharp Change in the	W73-03050 8B A Method Utilizing an Integral Formulation of	Concerning Velocity Distributions in Turbulent Flow at Porous Surfaces,
Roughness of the Surface at Which Flow Takes Place.	Problems of Natural Vibrations of Shells in the	W73-03059 8B
W73-03058 8B	Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in-	The Structure of Turbulent Flows Adjacent to
Experimental Study of the Structure of Turbu-	tegrale du probleme des vibrations propres de	Walls, W73-03060 8B
lent Boundary Layers in Incompressible Fluids in the Presence of a Longitudinal Pressure	coques en presence d'un fluide incompressi- ble),	
Gradient,	W73-03051 8B	Experimental Study of the Structure of Turbu- lent Boundary Layers in Incompressible Fluids
W73-03061 8B	Damping of Natural Vibrations of an Immersed	in the Presence of a Longitudinal Pressure Gradient,
LOW AROUND OBJECTS Experimental Investigation of Effects of Un-	Cylindrical Shell with Free Ends: Influence of Confinement of the Fluid by an Axial Shell	W73-03061 8B
steady Flows on a Submerged Cylinder,	(Amortissement des vibrations propres d'une coque cylindrique immergee et libre a ses deux	On the Equilibrium of a Cable Connected to a
W73-03019 8B	extr emites: influence du confinement du fluide	Free-Floating Body Placed in a Stream,
Loss of Pressure Due to Periodic Movement of an Obstacle (Sur la perte de charge due a un	par une coque axiale), W73-03052	W73-03062 , 8B
obstacle en mouvement periodique),	Study of Viscous Hydraulic Damping of	FLUORIDES An Epidemiological Study of the Effect of
W73-03020 8B	Breathing Vibrations of a Cylindrical Shell in a	Fluorides in Drinking Water on the Frequency of Slipped Capital Femoral Epiphysis,
Forces Due to Cylinders Falling Through Water in a Vertical Tube,	Fluid at Rest (Etude de l'amortissement hydraulique visqueux des vibrations de respira-	W73-03071 SF
W73-03021 8B	tion d'une coque cylindrique dans un fluide au	FOG
Flow-Induced Dynamic Pressures on Square-	repos), W73-03053	Project Fog Drops. Part 1: Investigations of
Section Cylinders, W73-03022 8B	Study of the Hydraulic Damping of the Vibra-	Warm Fog Properties, W73-02782 2B
Drag Coefficient and Turbulence Charac-	tions of a Rod in the Turbulent Regime (Etude de l'amortissement hydraulique de la vibration	Project Foggy Cloud III, Phase 1,
teristics,	d'une baguette en regime turbulent),	W73-03145 3B
W73-03023 8B	W73-03054 8B	FOG DATA
Wake Dynamics of Two-Dimensional Struc- tures in Confined Flows,	Critical Water Depth for Hydrodynamic In- duced Oscillation of Cantilevered Cylinders,	Project Fog Drops. Part 1: Investigations of Warm Fog Properties,
W73.03024 RB	W73.03055 R	W73-02782 28

FOG DIEPERSION	FRACTURES	FUTURE PLANNING (PROJECTED)
Project Foggy Cloud III, Phase 1,	Stresses and Movements in Oroville Dam,	Problem-Oriented Computer Languages in
W73-03145 3B	W73-02849 8D	Hydraulic Engineering: A Brief Overview of
FOG SEEDING TECHNIQUES	FRACTURES (GEOLOGIC)	Their Evolution, State of the Art and Future,
Project Foggy Cloud III, Phase 1,	Specific Capacities of Wells in Crystalline	W73-03245 7C
W73-03145 3B	Rocks,	GALAXIAS MACULATUS
SAME STATE OF THE PROPERTY OF THE PARTY OF T	W73-02800 4B	The Biology of a Landlocked Form of the Nor-
FOOD CHAINS		mally Catadromous Salmoniform Fish Galaxias
Uptake of Rulo6 by Marine Organisms in	On the Flow of Two Immiscible Fluids in Frac- tured Porous Media,	Maculatus (Jenyns): I. Life Cycle and Origin, W73-02855
Aquaria and in the Natural Environment (Ob- servations Concernant les Contaminations Ex-	W73-02828 2F	11
perimentales et les Contaminations 'In situ'	the particular of a last transport to a substitute M	The Biology of a Landlocked Form of the Nor-
D'especes Marines Par Le Ru106,	FRANCE	mally Catadromous Salmoniform Fish Galaxias
W73-02717 5B	The Association of Littorella Uniflora and	Maculatus (Jenyns): II. Morphology and Syste- matic Relationships.
Summarium on Padioscalory Applied to the	Eleocharis Acicularis in the 'Entre-Sambre-Et- Meuse.'	W73-02856 21
Symposium on Radioecology Applied to the Protection of Man and His Environment.	W73-02691 2I	Particular and American Company
W73-02722 5B		GAMMA LOGGING
The state of the s	RU106 Distribution in a Reduced Model Simu-	The Use of Gamma Logs in Determining the Character of Unconsolidated Sediments and
Environmental Dynamics of Mercury,	lating River Banks; Some Hydrodynamic and	Well Construction Features,
W73-02729 5B	Kinetic Aspects of Its Adsorption on Sedi-	W73-02802 4B
FOODS	ments (Repartition Du RU106 Dans Un Modele Reduit Simulant Les Berges D'Une Rivi ere),	The State of the S
Effectiveness of the Use of Nutrients in Food	W73-02724 5B	GAMMA RAYS
Mixtures by Rainbow Trout, (In Russian),	and the Artist Arm Annual Control of the Control of	The Use of Gamma Logs in Determining the Character of Unconsolidated Sediments and
W73-02896 8I	Effects of an Artificial Stream on Marine Com-	Well Construction Features,
BODEC LOTTEG	munities,	W73-02802 4B
FORECASTING Energy Input-Output Climates of the World: A	W73-03171 5C	14 - 2011
Preliminary Attempt.	FREEZING	GAS CHROMATOGRAPHY
W73-02647 2B	Separator-Melter Unit for Desalination,	Feasibility Study of the Application of Solvent Extraction and Gas-Liquid Partition Chro-
PHITPIDS IA AVIOLE, THE PARTY OF THE	W73-03012 3A	matography to Marine Trace Metal Analysis,
Comprehensive Survey of Elk River Basin,		W73-02747 5A
Volume II, Economic Base Study, W73-02860 6D	FUEL MOVEMENT EVOLUTION Reduction of Oil Spills During Shipboard Fuel	176/3/46
W73-02860 6D	Movement Evolutions,	An Effect of Water Stress on Ethylene Produc- tion by Intact Cotton Petioles,
A Computer Simulation Model for Flood Plain	W73-02907 5G	W73-03112 3F
Development, Part 1: Land Use Planning and	to the first first on a second to the second to the	W15-05112
Benefit Evaluation,	FUEL OIL	GASES
W73-02944 4A	Reduction of Oil Spills During Shipboard Fuel	Environmental Radiation Dosimetry Near
A Methodology for Estimating the Benefits to	Movement Evolutions, W73-02907 5G	Large Nuclear Power Stations, W73-02742 SB
Irrigated Agriculture from Increased Accuracy	W13-02501	W /3-02/42
in Seasonal Streamflow Forecasts,	FUEL PIER UTILIZATION	GATE SEATS
W73-03130 3F	Analysis of the Effects on Oil Spills of Fuel	Hydraulic Downpull Increase at a Dam Gate
Great Lakes Simulation ModelA Decision	Policy Changes and the Addition of Another	Caused by Hydrodynamic Forces, W73-03043 8B
Aid.	Fuel Pier with the Aid of a Computer Simula- tion Model.	W 73-03043
W73-03234 2H	W73-02908 5G	GATES
ESTATION OF THE PARTY OF THE PA	117-02500	Theoretical Study on Flap Gate Oscillation,
FOREST PONDS	FUEL PIERS	W73-03044 8B
Peculiarities of the Phytoplankton Species	Analysis of the Effects on Oil Spills of Fuel	Hydrodynamic Forces Caused by Unsteady
Composition of Some Forest Ponds, W73-02644 21	Policy Changes and the Addition of Another Fuel Pier with the Aid of a Computer Simula-	Slot Flow on Vertical Leaf Gates,
A second second second second second	tion Model,	W73-03045 8B
FORESTS	W73-02908 5G	Investigation of Nonstationary Hydrodynamic
Dynamics of the Poplar Forest Associations in	OF SERVICE AND PROPERTY OF STREET	Forces Induced by a Plate Oscillating in Liquid
River Basins of the Lake Baikal Southeastern	FUELS	Flow (Two-Dimensional Problem),
Shore, (In Russian), W73-02881 4A	Fuel Cycles and the Fast Breeder Reactor, W73-02765 5G	W73-03050 8B
The state of the s	W73-02765 5G	GEOCHEMISTRY
FOULING	Reduction of Oil Spills During Shipboard Fuel	Trace-Metal Associations in Sub-Artic and Arc-
Fouling: The Major Unresolved Problem in	Movement Evolutions,	tic Marine Environments - Progress Report,
Heat Transfer, W73-02775 8B	W73-02907 5G	June 1971-May 1972,
W73-02775 8B	Analysis of the Effects on Oil Spills of Fuel	W73-02754 5B
FOULING RESISTANCE	Policy Changes and the Addition of Another	Environmental Geochemistry in Health and
Fouling: The Major Unresolved Problem in	Fuel Pier with the Aid of a Computer Simula-	Disease.
Heat Transfer,	tion Model,	W73-03196 5B
W73-02775 8B	W73-02908 5G	GEOLOGIC INVESTIGATIONS
FRACTURE PERMEABILITY	FUNGI	Two Models for Horton's Law of Stream Num-
Specific Capacities of Wells in Crystalline	Nutrient Status and Mycorrhizal Enhancement	bers,
Rocks,	of Water Transport in Soybean,	W73-03079 . 4A
W73-02800 4B	W73-03087 3F	CROLOGY
On the Flow of Two Immiscible Fluids in Frac-	An Ecological Study of the Soil Microfungi in a	GEOLOGY Geology, Soils, and Hydrogeology of Volo Bog
tured Porous Media,	Hawaiian Mangrove Swamp,	and Vicinity, Illinois.
W72 02020 ATC	W22.0206 21	W73-02657 2H

B

of ocy
5F
of 2B
3B
of 2B

Heat Barriage District Balans period to W73-02

Dynami yl'chek lednika W73-02

Morpho Mechan fologiya mekhan W73-02

Secular poluvek skikh le W73-02

Mechan minal M Erosion 'konech dinamik W73-02

Glacier Water S er, W73-02

GLACIOI Some F ryye Shanya W73-02

Mass B Norther (Byudzi Terskey kak), W73-02

Water Basin (1 primere W73-02

Ablation nika Ser W73-02

Heat Barace Disalans period to W73-02

Dynami yl'chek lednika W73-02

Morpho Mechan fologiya mekhan W73-02

Secular poluvek skikh le W73-02

Mechan minal M Erosion

GEOLOGY

GEOLOGY		
Ground-Water Resources and Geology of Cook	'konechnykh moren' i rol' vodnoy erozii v	GLACIER FLOW
County, Georgia,	dinamike lednika),	Dynamics and Structure of the Yuzhnyy In-
W73-02807 4B	W73-02642 2C	yl'chek Glacier (Voprosy dinamiki i struktury lednika Yuzhnyy Inyl'chek),
GEOMORPHOLOGY	GLACIAL-LAKE OUTBURSTS	W73-02639 2C
An Application of Multi-variate Analysis in Hydrology.	Morphology of Glacial Lake Merzbacher and Mechanics of its Catastrophic Outburst (Mor-	GLACIER MASS BALANCE
W73-02873	fologiya lednikovogo ozera Mertsbakhera i	Some Features of Tien Shan Glaciers (Nekoto-
Pediments and Terraces along the Moapa Val-	mekhanizm yego katastroficheskikh proryvov), W73-02640 2C	ryye zakonomernosti oledeneniya Tyan'- Shanya).
ley, Clark County, Nevada,	W73-02640 2C	W73-02633 2C
W73-03146 2J	GLACIAL LAKES	GLACIER MASS BUDGET
GEOPHYSICS	Morphology of Glacial Lake Merzbacher and Mechanics of its Catastrophic Outburst (Mor-	Mass Budget of the Kara-Batkak Glacier on the
Eddy Diffusion Coefficients due to Instabilities in Internal Gravity Waves,	fologiya lednikovogo ozera Mertsbakhera i	Northern Slope of the Terskey Ala-Too Range
W73-02776 2E	mekhanizm yego katastroficheskikh proryvov), W73-02640 2C	(Byudzhet lednikov severnogo sklona khrebta Terskey Ala-Too na primere lednika Kara-Bat-
GEORGIA	The second secon	kak),
Water Resources Data for Georgia1971.	GLACIAL STREAMS	W73-02634 2C
W73-02784 7C	Water Balance of the Kara-Batkak Glacier Basin (Vodnyy balans lednikovogo basseyna na	Water Balance of the Kara-Batkak Glacier
Ground-Water Resources and Geology of Cook	primere lednika Kara-Batkak),	Basin (Vodnyy balans lednikovogo basseyna na primere lednika Kara-Batkak),
County, Georgia, W73-02807	W73-02635 2C	W73-02635 2C
The Formal Courte, Cons. In Committee the	Mechanism of the Formation of Some 'Ter-	Ablation of the Semenov Glacier (Tayaniye led-
Aggregate Returns from Water Resource Development in Georgia, 1946 -1965,	minal Moraines' and Role of Water in Glacial	nika Semenova),
W73-02919 6B	Erosion (Mekhanizm obrazovaniya nekotorykh 'konechnykh moren' i rol' vodnoy erozii v	W73-02636 2C
GEOSMIN	dinamike lednika),	Rate of Movement, Ablation, and Dynamics of
Production of Geosmin and 2-Exo-Hydroxy-2-	W73-02642 2C	Some Glaciers of the Ak-Shiyrak Range
Methylbornane by Streptomyces odorifer,	GLACIATION	(Skorostnoy rezhim, tayaniye i dinamika neko- torykh lednikov massiva Ak-Shiyrak),
W73-02949 5A	Some Features of Tien Shan Glaciers (Nekoto-	W73-02637 2C
GERMANY	ryye zakonomernosti oledeneniya Tyan'- Shanya).	GLACIER RETREAT
Investigations into the Formation of Biogenetic Vertical Tubes in the Subsoil of Diked Marshes	W73-02633 2C	Secular Growth of Some Tien Shan Glaciers (0
in Schleswig-Holstein, (In German),	Secular Growth of Some Tien Shan Glaciers (O	poluvekovom razvitii nekotorykh Tyan'-Shan'- skikh lednikov).
W73-02687 2I	poluvekovom razvitii nekotorykh Tyan'-Shan'-	W73-02641 2C
GERMINATION	skikh lednikov),	GLACIER RUNOFF
Germination Behaviour of a Weed and Three Related Crop Plants Under Various Conditions	W73-02641 2C	Water Balance of the Kara-Batkak Glacier
of Soil Water Content and Temperature,	Mechanism of the Formation of Some 'Ter-	Basin (Vodnyy balans lednikovogo basseyna na
W73-02673 3F	minal Moraines' and Role of Water in Glacial Erosion (Mekhanizm obrazovaniya nekotorykh	primere lednika Kara-Batkak), W73-02635 2C
Interaction of Temperature and Salinity on	'konechnykh moren' i rol' vodnoy erozii v	GLACIER SURFACES
Sugar Beet Germination,	dinamike lednika), W73-02642 2C	Heat Balance of the Kara-Batkak Glacier Sur-
W73-03084 3C	W 13-02042	face During an Ablation Season (Teplovoy
Rehydration of Phytochrome in Imbibing Seeds of Amaranthus retroflexus L.,	GLACIER ACTIVITY Secular Growth of Some Tien Shan Glaciers (O	balans poverkhnosti lednika Kara-Batkak v period tayaniya),
W73-03086 2I	poluvekovom razvitii nekotorykh Tyan'-Shan'-	W73-02638 2C
Salt Tolerance of Safflower Varieties	skikh lednikov),	GLACIERS
(Carthamus tinctorius L.) During Germination,	W73-02641 2C	Some Features of Tien Shan Glaciers (Nekoto-
W73-03088 3C	GLACIER ADVANCE	ryye zakonomernosti oledeneniya Tyan'-
Eco-Physiological Studies on Desert Plants. III.	Secular Growth of Some Tien Shan Glaciers (O poluvekovom razvitii nekotorykh Tyan'-Shan'-	Shanya). W73-02633 2C
Respiration of Negatively Photoblastic	skikh lednikov),	Mass Budget of the Kara-Batkak Glacier on the
Zygophyllum coccineum L. Seeds During Ger- mination,	W73-02641 2C	Northern Slope of the Terskey Ala-Too Range
W73-03116 2I	GLACIER DYNAMICS	(Byudzhet lednikov severnogo sklona khrebta
GLACIAL DRIFT	Rate of Movement, Ablation, and Dynamics of	Terskey Ala-Too na primere lednika Kara-Bat- kak),
Some Features of Tien Shan Glaciers (Nekoto-	Some Glaciers of the Ak-Shiyrak Range (Skorostnoy rezhim, tayaniye i dinamika neko-	W73-02634 2C
ryye zakonomernosti oledeneniya Tyan'- Shanya).	torykh lednikov massiva Ak-Shiyrak),	Water Balance of the Kara-Batkak Glacier
W73-02633 2C	W73-02637 2C	Basin (Vodnyy balans lednikovogo basseyna na
Mechanism of the Formation of Some 'Ter-	Dynamics and Structure of the Yuzhnyy In-	primere lednika Kara-Batkak), W73-02635 2C
minal Moraines' and Role of Water in Glacial	yl'chek Glacier (Voprosy dinamiki i struktury	HE WORK I WAS A STATE OF THE PARTY OF THE PA
Erosion (Mekhanizm obrazovaniya nekotorykh 'konechnykh moren' i rol' vodnoy erozii v	lednika Yuzhnyy Inyl'chek), W73-02639 2C	Ablation of the Semenov Glacier (Tayaniye led- nika Semenova),
dinamike lednika).	Language of the Control of the Contr	W73-02636 2C
W73-02642 2C	Mechanism of the Formation of Some 'Ter- minal Moraines' and Role of Water in Glacial	Rate of Movement, Ablation, and Dynamics of
GLACIAL EROSION	Erosion (Mekhanizm obrazovaniya nekotorykh	Some Glaciers of the Ak-Shiyrak Range
Mechanism of the Formation of Some 'Ter-	'konechnykh moren' i rol' vodnoy erozii v dinamike lednika),	(Skorostnoy rezhim, tayaniye i dinamika neko- torykh lednikov massiva Ak-Shiyrak),
minal Moraines' and Role of Water in Glacial Erosion (Mekhanizm obrazovaniya nekotorykh	W73-02642 2C	W73-02637 2C

Heat Balance of the Kara-Batkak Gincier Sur- face During an Ablation Season (Teplovoy balans poverkhnosti lednika Kara-Batkak v	'konechnykh moren' i rol' vodnoy erozii v dinamike lednika), W73-02642 2C	An Integrated System for Providing Power, Water and Food for Desert Coasts, W73-03099 3F
period tayaniya), W73-02638 2C	GLOBAL CLIMATE CLASSIFICATION Energy Input-Output Climates of the World: A	Vegetable Production Under Plastic on the Desert Seacoast of Abu Dhabi,
Dynamics and Structure of the Yuzhnyy In- yl'chek Glacier (Voprosy dinamiki i struktury	Preliminary Attempt, W73-02647 2B	W73-03110 3F GROUNDWATER
lednika Yuzhnyy Inyl'chek), W73-02639 2C	GLOBAL HYDROLOGY Global Hydrology,	Groundwater Flow in Partially Saturated Soils, W73-02624 5B
Morphology of Glacial Lake Merzbacher and Mechanics of its Catastrophic Outburst (Mor-	W73-03057 2A GLOSSARIES	Regional Hydrogeologic Investigations in Kazakhstan (Regional'nyye
fologiya lednikovogo ozera Mertsbakhera i mekhanizm yego katastroficheskikh proryvov), W73-02640 2C	A Glossary of Coastal Engineering Terms. W73-02654 8B	gidrogeologicheskiye issledovaniya v Kazakh- sta
Sandar County of Sand Time Share Charles (O	GOLDEN SHINERS	W73-02809 4B
Secular Growth of Some Tien Shan Glaciers (O poluvekovom razvitii nekotorykh Tyan'-Shan'- skikh lednikov),	Growth Characteristics, Structure and Abundance of Abramis Brama (L.) In the Water Passages of the Summer Diked Marshes	Groundwaters of Kazakhstan and Recommen- dations Regarding Their Use in the National Economy for 1976-80 (Podzemnyye vody
W73-02641 · 2C Mechanism of the Formation of Some Ter-	of the Nyamunus Delta (In Russian), W73-02678 5C	Kazakhstana i rekomendatsii po ikh ispol'- zovaniyu v narodnom khozyaystve v period s
minal Moraines' and Role of Water in Glacial	Children Company Inches	1976 po 1980 g.),
Erosion (Mekhanizm obrazovaniya nekotorykh 'konechnykh moren' i rol' vodnoy erozii v	Mercury Pollution of Golf Course Lakes,	W73-02810 4B Role of Groundwater in Maintaining the Level
dinamike lednika), W73-02642 2C	W73-02615 5B GOOSEBERRIES D	of Lake Balkhash (Rol' podzemnykh vod v podderzhanii urovnya oz. Balkhash),
Glacier Surveys by District Personnel of the	The Response of Gooseberries to Non-Tillage	W73-02811 4B
Water Survey of Canada: 1. The Victoria Glacier,	Systems of Management, W73-02699 3F	Prospects of Using Groundwaters Along the Ir-
W73-02648 2C	GRADATION	tysh River Near Semipalatinsk in the National Economy (Perspektivy ispol'zovaniya podzem-
CLACIOLOGY	A Rapid Grain Size Analysis Method,	nykh vod Semipalatinskogo Priirtysh'ya v
Some Features of Tien Shan Glaciers (Nekotoryye zakonomernosti oledeneniya Tyan'-	W73-03249 8D	narodnom khozyaystve), W73-02812 _. 4B
Shanya). W73-02633 2C	GRADATION ANALYSIS A Rapid Grain Size Analysis Method, W73-03249 8D	Water Resources of the Uspenskiy Mining Dis- trict and a Technical and Economic Justifica-
DATE OF THE PROPERTY OF THE PR		tion of Their Use (Vodnyye resursy Uspen-
Mass Budget of the Kara-Batkak Glacier on the Northern Slope of the Terskey Ala-Too Range (Byudzhet lednikov severnogo sklona khrebta Terskey Ala-Too na primere lednika Kara-Bat-	GRAND CANYON Environmental Influence on the Pattern of Plant Communities Along the North Rim of the	skogo rudnogo poyasa i tekhniko- ekonomicheskoye obosnovaniye ikh ispol'- zovaniya),
kak),	Grand Canyon, W73-03078 2I	W73-02814 4B
W73-02634 2C	GRASS-M	Monitoring Groundwater Reservoirs in Pied- mont Plains of Tien Shan (Upravleniye
Water Balance of the Kara-Batkak Glacier Basin (Vodnyy balans lednikovogo basseyna na primere lednika Kara-Batkak),	Biological Background of High-Productive Pastures and the Quality of the Feed (In Rus-	rezhimom podzemnykh vod na predgornykh ravninakh Tyan' -Shanya), W73-02815
W73-02635 2C	sian), W73-03180 3F	
Ablation of the Semenov Glacier (Tayaniye led- nika Semenova),	GRAYLINGS	Occurrence of Groundwater in the Piedmont Alluvial Plain on the Northern Slope of Dzun-
W73-02636 2C	Some Blood Characteristics in Black Baikal Grayling Thymallus articus Baicalensis Dyb. With Reference to the Estimation of the Grow-	garian Ala Tau (Formirovaniye podzemnykh vod predgornogo shleyfa severnogo skiona Dz- hungarskogo Alatau),
Heat Balance of the Kara-Batkak Glacier Sur-	ing Conditions (In Russian),	W73-02816 . 4B
face During an Ablation Season (Teplovoy balans poverkhnosti lednika Kara-Batkak v	W73-03111 8I	Groundwater of the Akdala River Valley and
period tayaniya), W73-02638 2C	GREAT LAKES Milwaukee Diked Disposal Area, Wisconsin,	Prospects of its Use as a Water-Supply Source (Podzemnyye vody doliny r. Akdala i perspek-
Dynamics and Structure of the Yuzhnyy In- yl'chek Glacier (Voprosy dinamiki i struktury	(Draft Environmental Impact Statement). W73-03151 5G	tivy ikh ispol'zovaniya diya vodosnabzheniya), W73-02817 4B
lednika Yuzhnyy Inyl'chek), W73-02639 2C	Great Lakes Simulation ModelA Decision Aid,	GROUNDWATER AVAILABILITY Regional Hydrogeologic Investigations in
Morphology of Glacial Lake Merzbacher and	W73-03234 2H	Kazakhstan (Regional'nyye gidrogeologicheskiye issledovaniya v Kazakh-
Mechanics of its Catastrophic Outburst (Mor-	GREENHOUSES	sta
fologiya lednikovogo ozera Mertsbakhera i mekhanizm yego katastroficheskikh proryvov),	Scrubbed Diesel Exhaust for Carbon Dioxide Enrichment of Greenhouse Vegetables,	W73-02809 4B
W73-02640 2C	W73-03074 3F	Groundwaters of Kazakhstan and Recommen- dations Regarding Their Use in the National
Secular Growth of Some Tien Shan Glaciers (O poluvekovom razvitii nekotorykh Tyan'-Shan'- skikh lednikov),	Use of Digital Computers for the Heat and Mass Transfer Analyses of Controlled Environ- ment Greenhouses, W73-03082 2D	Economy for 1976-80 (Podzemnyye vody Kazakhstana i rekomendatsii po ikh ispol'- zovaniyu v narodnom khozyaystve v period s
W73-02641 2C	le (filescont les moral (mappesson)	1976 po 1980 g.), W73-02810 4B
Mechanism of the Formation of Some 'Ter- minal Moraines' and Role of Water in Glacial Erosion (Mekhanizm obrazovaniya nekotorykh	A Plastic Inflated Environmental Growth Chamber, W73-03095 3F	Prospects of Using Groundwaters Along the Ir- tysh River Near Semipalatinsk in the National

HEAT Se Ablati nika S W73-0

Heat I face I balans period W73-0

HEAT TO Fouling Heat T W73-00 Station water I W73-00

Some
Porous
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Applica Heavy W73-02

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Pollute
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HELIUM
Soundis
W73-02
HERBICI
Morpho
Varietic
W73-03

Organo Polychl Nakatpa W73-03

The In Respira lus (O.F W73-03

HERBIVO (In Russ W73-02' HERBIVO Feeding vae Rais W73-026

GROUNDWATER AVAILABILITY

Economy (Perspektivy ispol'zovaniya podzem- nykh vod Semipalatinskogo Priirtysh'ya v narodnom khozyaystve),	The Availability of Ground Water in Kent County, Delaware, With Special Reference to the Dover Area,	The Impact of Water Development on Ecology of the Gulf of Mexico, W73-03070 5B
W73-02812 4B	W73-02806 4B	HABITATS
GROUNDWATER MOVEMENT Thermodynamic Analogy of Mass Transport Processes in Porous Media, W73-02819 2F	Ground-Water Resources and Geology of Cook County, Georgia, W73-02807	The Composition and Distribution of the Fish Fauna of the Navasota River, W73-02613
Stationary Heat Transport by Plane Ground- water Movement in a Thin or a Thick Layer, W73-02820 2F	Regional Hydrogeologic Investigations in Kazakhstan (Regional'nyye gidrogeologicheskiye issledovaniya v Kazakh- sta	HALIDES Effect of Dissolved Salts on Water Solubility of Lindane, W73-03185 5G
The Significance of the Net Transfer of Viscous Stress Energy and the Local Produc- tion of Kinetic Energy in Stationary Soil Water Flow,	W73-02809 Groundwaters of Kazakhstan and Recommendations Regarding Their Use in the National Economy for 1976-80 (Podzemnyye vody	HALOPHYTES Mineral Ion Composition of Halophytic Species from Northern Utah, W73-03117 21
W73-02821 2G	Kazakhstana i rekomendatsii po ikh ispol'-	HANDBOOKS
On the Plane Steady Flow Through In- homogeneous Porous Media,	zovaniyu v narodnom khozyaystve v period s 1976 po 1980 g.), W73-02810 4B	Village Technology Handbook. W73-02922 8A
W73-02824 2F	W73-02810	HARBORS
A Numerical Study of the Nonlinear Laminar Regime of Flow in an Idealised Porous Medi-	Prospects of Using Groundwaters Along the Ir- tysh River Near Semipalatinsk in the National	Sewage Treatment System, W73-02983 5D
um, W73-02825 2F	Economy (Perspektivy ispol'zovaniya podzem- nykh vod Semipalatinskogo Priirtysh'ya v narodnom khozyaystve),	U. S. Deepwater Port StudyThe Environmen- tal and Ecological Aspects of Deepwater Ports.
The Reciprocity Principle in Flow Through	W73-02812 4B	W73-03136 8A
Heterogeneous Porous Media, W73-02827 4B	Monitoring Groundwater Reservoirs in Pied- mont Plains of Tien Shan (Upravleniye	Fall River Harbor, Massachusetts and Rhode Island (Draft Environmental Impact State-
On the Flow of Two Immiscible Fluids in Frac-	rezhimom podzemnykh vod na predgornykh	ment). W73-03144
tured Porous Media, W73-02828 2F	ravninakh Tyan' -Shanya), W73-02815 4B	Milwaukee Diked Disposal Area, Wisconsin,
	Development of Ground-Water Resources in	(Draft Environmental Impact Statement).
Model Tests to Study Groundwater Flows Using Radioisotopes and Dye Tracers, W73-02838 2F	the Orange County Area, Texas and Louisiana, 1963-71,	W73-03151 5G HARTFORD NORTH QUADRANGLE (CONN)
Shallow Aquifers Relative to Surface Waters,	W73-03139 4B GROWTH CHAMBERS	Location of Wells and Test Holes, Hartford North Quadrangle, Connecticut,
North Platte River Valley, Goshen County, Wyoming,	A Plastic Inflated Environmental Growth	W73-03153 7C
W73-02900 4B	Chamber, W73-03095 3F	Sites of Solid-Waste Storage and Liquid-Waste Discharge, Hartford North Quadrangle, Con-
GROUNDWATER RECHARGE	An Integrated System for Providing Power,	necticut, W73-03154 7C
Monitoring Groundwater Reservoirs in Pied- mont Plains of Tien Shan (Upravleniye rezhimom podzemnykh vod na predgornykh	Water and Food for Desert Coasts, W73-03099 3F	Maximum Concentration of Dissolved solids in
ravninakh Tyan' -Shanya), W73-02815 4B	Vegetable Production Under Plastic on the	Surface Water, Hartford North Quadrangle, Connecticut,
	Desert Seacoast of Abu Dhabi, W73-03110 3F	W73-03155 7C
GROUNDWATER RESOURCES Water for Industrial Development in Copiah		HAWAII
and Simpson Counties, Mississippi, W73-02651 3E	GROWTH (FISH) Age and Growth of Pike in Five Irish Limestone Lakes,	An Ecological Study of the Soil Microfungi in a Hawaiian Mangrove Swamp, W73-03205 21
Geology and Ground Water of the Pajaro Val-	W73-02883 8I	v Schollen X of stated from Versyng applied to
ley Area, Santa Cruz and Monterey Counties,	Feeding and Growth of Herbivorous Fish Lar-	HEAT A Method for Calculating the Size of Cooling
California, W73-02653 4B	vae Raised in Ponds for Fry, (In Russian), W73-02898	Tower Plumes, 'W73-02763 5G
The Nature and Extent of Peat Deposits and Possible Effects of Peat Mining on Manmade	GROWTH RATES	Discharge of Waste Heat,
Features and Springs Near Mescalero, New Mexico,	The Interaction of Sewage, Thermal, and Acid Mine Water Loadings on the Growth of	W73-02770 SC Handling Hot Water, With A Payoff,
W73-02661 4B	Chlorella, W73-02974 5C.	W73-02780 SG
The Availability of Ground Water in New Cas-	Control of the Contro	HEAT BALANCE
tle County, Delaware, W73-02785 4B	GROWTH STAGES Low Level Chronic Irradiation of Salmon. Annual Progress Report,	Heat Balance of the Kara-Batkak Glacier Surface During an Ablation Season (Teplovoy
Water for a Rapidly Growing Urban Communi- ty-Oakland County, Michigan,	W73-02714 . 5C	balans poverkhnosti lednika Kara-Batkak v period tayaniya), W73-02638 2C
W73-02804 3D	GULF OF MEXICO	"Million of Alasmonia, Alvania, and Betharty of
The Availability of Ground Water in Eastern Sussex County, Delaware,	Contemporary Sources and Geochemistry of Tritium in the Gulf of Mexico and its Distribu- tive Province,	HEAT EXCHANGERS Fouling: The Major Unresolved Problem in Heat Transfer,
W73-02805 4B	W73-02730 5B	W73-02775

HYDRAULIC CONDUCTIVITY

HETEROGENEITY

HEAT SOURCES

21

G

oy v 2C

8B

Ablation of the Semenov Glacier (Tayaniye led- nika Semenova), W73-02636 2C	On the Plane Steady Flow Through In- homogeneous Porous Media, W73-02824 2F	Vertical and Horizontal Laboratory Permeability Measurements in Clay Soils, W73-02833
	TO SERVICE OF THE PROPERTY OF	mersion self-up impressions) in the
Heat Balance of the Kara-Batkak Glacier Sur- face During an Ablation Season (Teplovoy balans poverkhnosti lednika Kara-Batkak v period tayaniya),	HIMALAYA MOUNTAINS Nimbus 3 and 4 Observations of Snow Cover and Other Hydrological Features in the Western Himalayas,	Patterns of Water Uptake and Root Distribu- tion of Soybeans (Glycine max.) in th Presence of a Water Table, W73-03114
W73-02638 2C	W73-03134 7B	Marie Control of the
HEAT TRANSFER Fouling: The Major Unresolved Problem in Heat Transfer, W73-02775 8B	HISTORIC FLOODS Map Showing Drainage Basins and Historic Cloudburst Floods in the Salina Quadrangle, Utah.	HYDRAULIC DESIGN Optimized Geometry for Baffle Blocks is Hydraulic Jumps, W73-03036
Stationary Heat Transport by Plane Ground- water Movement in a Thin or a Thick Layer, W73-02820 2F	W73-03152 7C	Hydraulic Downpull Increase at a Dam Gat Caused by Hydrodynamic Forces, W73-03043
Some Aspects of Heat and Mass Transfer in Porous Media,	Man and Water: A Lesson in History, W73-03090	Theoretical Study on Flap Gate Oscillation, W73-03044
W73-02823 2F	HISTROY	Hydrodynamic Forces Caused by Unstead
HEATED JETS Diffusion of Thermally Buoyant Water Jets into a Moving Water Stream,	Problem-Oriented Computer Languages in Hydraulic Engineering: A Brief Overview of Their Evolution, State of the Art and Future, W73-03245	Slot Flow on Vertical Leaf Gates, W73-03045 8 HYDRAULIC ENGINEERING
W73-02627 5B	HOLDING CAPACITY OF SOIL	Problem-Oriented Computer Languages i
HEATED WATER Discharge of Waste Heat, W73-02770 5C	Effect of an Asphalt Barrier on Water Redis- tribution after Infiltration in Sandy Soils, W73-03189 2G	Hydraulic Engineering: A Brief Overview of Their Evolution, State of the Art and Future, W73-03245
Handling Hot Water, With A Payoff,	to be the second of the second of the second of the second	HYDRAULIC JUMP
W73-02780 5G	HORTONS LAW Two Models for Horton's Law of Stream Numbers,	Optimized Geometry for Baffle Blocks in Hydraulic Jumps,
HEATED WATERS	W73-03079 4A	W73-03036
Electrical Energy Needs and Environmental Problems, Now and in the Future.	construction of the contract o	Solution of Continuity and Momentum Equa
W73-02768 5C	HOT-FILM ANEMOMETERS Measurements of Turbulence in Water at High	tions of a Travelling Hydraulic Jump by Usin an Iterative Operator,
HEAVY METALS	Velocity,	W73-03150 8
Identification of Toxic Components in Oil	W73-02790 2E	
Refinery Effluents and Determination of Their Effect Upon the Aquatic Biota,	HOT SPRINGS Some Aspects of Heat and Mass Transfer in	HYDRAULIC MACHINERY Further Considerations on the Dynamic
W73-02609 5A	Porous Media,	Behaviour of Hydraulic Turbomachinery, W73-02846 8
Application of CF252 to the Detection of	W73-02823 2F	Coulon to only in the religion of the
Heavy Metals for Pollution Control, W73-02738 5A	HOWARD'S SOLUTION Optimal Operation of Serially-Linked Water	Brink Depth for Trapezoidal Broad-Creste
Process and a Product for the Purification of Polluted Water from Heavy Metal Ions Present	Reservoirs, W73-02707 4A	Weir, W73-02788
Therein, W73-02992 5D	HUDSON RIVER	Model Tests to Study Groundwater Flow Using Radioisotopes and Dye Tracers,
HELIUM COOLING	Environmental Sampling for River Sediments Around a Nuclear Power Station,	W73-02838
Sounding The All-In-One Nuclear Drum. W73-02764 5G	W73-02740 5B	The Magnitude of Shear Stresses Acting on the
	HUMAN DISEASES	Bottom of Open Channels by Propagatin Surge Waves,
HERBICIDES Morphological Response of Two Mesquite Varieties to 2,4,5-T and Picloram,	Antibodies Against Human Enteric Bacteria in Brown Bullheads (Ictalurus Nebulosus,	W73-03038
W73-03080 4A	Leseuer) from Contaminated Waters, W73-02975 5C	Forces Exerted on Small Structures by a Flu with a Free Surface in Alternating Movemen
Organochlorine Insecticide, Herbicide and Polychlorinated Biphenyl (PCB) Inhibition of Nakatpase in Rainbow Trout,	HUMBER ESTUARY (U.K) Nucella lapillus (L.) As a Predator of Edible Cockles,	(efforts exerces par un fluide a surface libre of mouvement alternatif sur des structures fines) W73-03039
W73-03165 5C	W73-02703 2L	Hydrodynamic Forces on Single Intake Gates,
The Influence of Herbicide 2,4-D-NA on Respiration and Survival of Simocephalus vetu- lus (O.F. Muller) (Cladocera),	HUMIC ACIDS Environmental Dynamics of Mercury,	W73-03046 8 HYDRAULIC SIMILITUDE
W73-03166 SC	W73-02729 5B	Forces Exerted on Small Structures by a Flu with a Free Surface in Alternating Moveme
HERBIVOROUS FISH Herbivorous Fish in Ponds for Peat Production, (In Russian),	HYBRID COMPUTERS A Self-Verifying Hybrid Computer Model of River-Basin Hydrology,	(efforts exerces par un fluide a surface libre e mouvement alternatif sur des structures fines) W73-03039
W73-02718 8I	W73-03183 2A	HYDRAULIC TRANSIENTS
HERBIVOROUS FISH LARVAE Feeding and Growth of Herbivorous Fish Lar-	HYDRATION Rehydration of Phytochrome in Imbibing Seeds	Experimental Investigation of Hydraul Transients in River-Reservoir Systems, Pha-
vae Raised in Ponds for Fry, (In Russian), W73-02898	of Amaranthus retroflexus L., W73-03086 21	III, W73-02706

Wate 1. Sur W73-

Annu ic Da Metro W73-

Geolo ley A Califo W73-6

Water Hawk nesota W73-0 Water W73-0 Veget tionsh W73-0

Hydro Soda I W73-0

Bathyr Washo W73-0

Data C W73-03 HYDROI Stocha W73-03 HYDROI Water Hawk nesota, W73-03 Water ! W73-03 Remoti W73-03

> Nimbus and C Wester W73-03

Hydrol Meteor W73-03 HYDROP Effects (Gossy, Cell Mi W73-03 HYDROS Hydrod to Barg, W73-03

HYDRAULIC TURBINES

HYDRAULIC TURBINES	Distribution of Averaged Flow Velocity in	Specific Capacities of Wells in Crystalline
A New Approach to Efficiency Guarantees, W73-02842 8C	Depth, W73-03049 8B	Rocks, W73-02800 4B
Further Considerations on the Dynamic	A Method Utilizing an Integral Formulation of Problems of Natural Vibrations of Shells in the	A New Technique for Estimating Recharge
Behaviour of Hydraulic Turbomachinery, W73-02846 8C	Presence of an Incompressible Fluid (A propos	Using a Digital Model, W73-02801 4B
HYDRAULICS	d'une methode utilisant une formulation in-	Regional Hydrogeologic Investigations in
Equivalent Roughness for Shallow Channels,	tegrale du probleme des vibrations propres de coques en presence d'un fluide incompressi-	Kazakhstan (Regional'nyye
W73-02786 8B	ble),	gidrogeologicheskiye issledovaniya v Kazakh-
Hydrodynamic Wave Uplift Forces on	W73-03051	sta W73-02809 4B
Horizontal Slabs, W73-03034 8B	Damping of Natural Vibrations of an Immersed	
Trajectory of Floating Bodies in a Strongly	Cylindrical Shell with Free Ends: Influence of Confinement of the Fluid by an Axial Shell	Groundwaters of Kazakhstan and Recommen- dations Regarding Their Use in the National
Deviating Fluid Vein. (Trajectoire de corps	(Amortissement des vibrations propres d'une	Economy for 1976-80 (Podzemnyye vody
flottants dans une veine fluide fortement	coque cylindrique immergee et libre a ses deux	Kazakhstana i rekomendatsii po ikh ispol'-
device),	extr emites: influence du confinement du fluide	zovaniyu v narodnom khozyaystve v period s
W73-03035 8B	par une coque axiale), W73-03052 8B	1976 po 1980 g.), W73-02810 4B
The Impact of the Jet on the Obstacle,	Study of Viscous Hydraulic Damping of	Prospects of Using Groundwaters Along the Ir-
W73-03037	Breathing Vibrations of a Cylindrical Shell in a	tysh River Near Semipalatinsk in the National
HYDROCHEMICAL REGIME	Fluid at Rest (Etude de l'amortissement	Economy (Perspektivy ispol'zovaniya podzem-
Hydrochemical Regime of Ponds Fertilized with Complex Concentrated Forms of Fertil-	hydraulique visqueux des vibrations de respira- tion d'une coque cylindrique dans un fluide au	nykh vod Semipalatinskogo Priirtysh'ya v
izer,	repos),	narodnom khozyaystve), W73-02812 4B
W73-02728 8I	W73-03053 8B	And the West of the Control of the C
HYDRODYNAMIC UPLIFT	Study of the Hydraulic Damping of the Vibra-	The Reciprocity Principle in Flow Through Heterogeneous Porous Media,
Hydrodynamic Wave Uplift Forces on	tions of a Rod in the Turbulent Regime (Etude	W73-02827 4B
Horizontal Slabs, W73-03034 8B	de l'amortissement hydrauliqué de la vibration d'une baguette en regime turbulent),	HYDROGEOSOGY
	W73-03054 8B	Role of Groundwater in Maintaining the Level
HYDRODYNAMICS	A PARTY	of Lake Balkhash (Rol' podzemnykh vod v
The Significance of the Net Transfer of Viscous Stress Energy and the Local Produc-	Critical Water Depth for Hydrodynamic In- duced Oscillation of Cantilevered Cylinders,	podderzhanii urovnya oz. Balkhash),
tion of Kinetic Energy in Stationary Soil Water	W73-03055 8B	-W73-02811 4B
Flow,	W. 1. 1. 1. E 1	HYDROGRAPH ANALYSIS
W73-02821 2G	Hydrodynamic Forces Acting on Sonic Oscilla- tors in Sonic Transmissions (Forces	Experimental Investigation of Converging
On the Plane Steady Flow Through In-	hydrodynamiques agissant sur les oscillateurs	Overland Flow, W73-03018 2E
homogeneous Porous Media, W73-02824 2F	soniques prevus dans les transmissions soniques),	/2 https://doi.org/10.1011/10.1011/
	W73-03056 8B	HYDROGRAPHS Flood Hydrographs for Ungaged Streams,
Hydrodynamic Forces on Diffuser Pipes Due to Barge Passage,	HYDROGEN ION CONCENTRATION	W73-02880 2E
W73-03032 8B	The Effect of pH on Aerobic Sludge Digestion,	A STATE OF THE PARTY OF THE PAR
W. L. L. S. D. S. C. N. S. C.	W73-02897 5D	HYDROLOGIC ASPECTS Impact of Snowpack Management on Snow-
Hydrodynamic Pressure of Nonstationary Flow in Canals Acting on Moored Ships,	Effects of Locomoter Restraint and of	And-Ice Hydrology,
W73-03033 8B	Anaesthesia with Urethane or MS-222 on the	W73-02851 3B
Hydrodynamic Wave Uplift Forces on	Reactions of Young Salmon (Salmo salahrL.) to	Application of a Digital Hydrologic Simulation
Horizontal Slabs,	Environmental Fluctuations of pH and Carbon Dioxide Tension,	Model to an Urbanized Watershed,
W73-03034 8B	W73-03169 5C	W73-02946 2A
The Impact of the Jet on the Obstacle,	Acidity and Lactate Content in the Blood of	Stochastic Analysis of Hydrologic Systems,
W73-03037 8B	Young Atlantic Salmon (Salmo salar L.) Ex-	W73-03235 2A
Hydraulic Downpull Increase at a Dam Gate	posed to High pCO2,	Application of Hydrologic Simulation to Water
Caused by Hydrodynamic Forces,	W73-03170 5C	Resources Planning,
W73-03043 8B	HYDROGEN RADIOISOTOPES	W73-03236 6A
Hydrodynamic Forces on Single Intake Gates,	Contemporary Sources and Geochemistry of Tritium in the Gulf of Mexico and its Distribu-	Data Collection for Water Systems Control,
W73-03046 8B	tive Province,	W73-03241 7C
Hydrodynamic Forces Due to Nonstationary	W73-02730 5B	HYDROLOGIC BALANCE
Oscillations of Cylindrical Shells in a Fluid Medium with Deformations of the Cross-Sec-	HYDROGEN SULFIDE	Tritium in Investigation of Surface Hydrology.
tion Taken into Account,	Removal of Dissolved Oxygen from Water,	Experimental Determination of Coefficient of
W73-03047 8B	W73-02988 5D	Runoff, W73-02713 5B
Natural Vibrations of Cylindrical Shells in a	Effects of Hydrogen Sulfide on Fish Eggs and	And the Control of th
Moving Fluid (Vibrations propres de coques	Fry,	HYDROLOGIC BUDGET
cylindriques en presence de fluide), W73-03048	W73-03164 5C	Global Hydrology, W73-03057 2A
characterist housestand theretaile	HYDROGEOLOGY	
On Hydroelastic Correlations Between Dif-	Geology, Soils, and Hydrogeology of Volo Bog	HYDROLOGIC CYCLE
ferent Forms of Oscillations of Plate in the Flow Boundary Resulting from Non-Uniform	and Vicinity, Illinois. W73-02657 2H	Global Hydrology, W73-03057
Donney resulting from 140th Children	211	611

HYDROLOGIC DATA	HYPERFILTRATION	IMPAIRED WATER QUALITY
Water Resources Data for Colorado, 1971: Part	Effect of Brine Disposal Cost on Hyperfiltra-	Effects of an Artificial Stream on Marine Com-
1. Surface-Water Records.	tion Plant Optimization,	munities,
W73-02643 7C	W73-02914 5E	W73-03171 5C
Annual Compilation and Analysis of Hydrolog-	HYPERFILTRATION PLANT	IMPOUNDMENTS
ic Data for Urban Studies in the Dallas, Texas	Effect of Brine Disposal Cost on Hyperfiltra-	Pre-Impoundment Boating Activity in the
Metropolitan Area, 1970,	tion Plant Optimization,	Saylorville Reservoir Area.
W73-02652 7C	W73-02914 5E	W73-02912 6B
Geology and Ground Water of the Pajaro Val-	ICE	INCOME
ley Area, Santa Cruz and Monterey Counties,	Stability of Floating Ice Blocks,	Aggregate Returns from Water Resource
California,	W73-02792 2C	Development in Georgia, 1946 -1965,
W73-02653 4B		W73-02919 6B
W	Separator-Melter Unit for Desalination, W73-03012	INCREASING WATER SUPPLIES
Water Resources of the Minnesota River-	W73-03012 3A	Performance of an Atmospheric Water
Hawk Creek Watershed, Southwestern Min- nesota.	Trajectory of Floating Bodies in a Strongly	Resources Research Program in the Hungry
W73-02663 7C	Deviating Fluid Vein, (Trajectoire de corps	Horse Area, Montana.
W 73-02003	flottants dans une veine fluide fortement	W73-03143 3B
Water Resources Data for Georgia1971.	device),	11.5-05145
W73-02784 7C	W73-03035 8B	INCREMENTAL COSTS
the Analystia Reposetion Light and	Done (ed., Our Sales), An Other Billion	A New Theory of Pricing and Decision-Making
Vegetation, Runoff, and Sediment Yield Rela-	ICE BREAKUP .	for Public Investment,
tionships,	Stability of Floating Ice Blocks,	W73-02917 6B
W73-03067 5B	W73-02792 2C	
The State of the S		Taxation and Pollution-Some Comments,
Hydrologic Reconnaissance of Big and Little	ICE COVER	W73-02935 5G
Soda Lakes, Churchill County, Nevada,	Stability of Floating Ice Blocks,	Cost Allocation for A Resiscal Balletine Treet
W73-03137 7C	W73-02792 2C	Cost Allocation for A Regional Pollution Treat- ment System.
And the second s	ICE CRYSTALS	
Bathymetric Reconnaissance of Big and Little	Separator-Melter Unit for Desalination,	W73-02937 5G
Washoe Lakes, Washoe County, Nevada,	W73-03012 3A	INDIA
W73-03138 7C	W 73-03012	Performance of Rainfed American Cotton
Data Collection for Water Systems Control,	ICE JAMS	(Gossypium hirsutum L.) under Three Sowing
W73-03241 7C	Stability of Floating Ice Blocks,	Times, Three Row Spacings and Three
W 73-03241 /C	W73-02792 2C	Nitrogen Levels in Nimar Tract of Madhya
HYDROLOGIC EQUATION	considered at district their M. British	Pradesh.
Stochastic Analysis of Hydrologic Systems,	IDAHO	W73-03201 3F
W73-03235 2A	Probability of Exceeding Capacity of Flood-	
W/S COSS	Control System at the National Reactor Testing	INDIANA
HYDROLOGIC SYSTEMS	Station, Idaho,	Nitrate Transformations in Surface Waters; I.
Some Extensions of Linear Systems Analysis	W73-02781 4A	A Study of Various Factors Affecting the Rates
in Hydrology,	IGNEOUS ROCKS	of Denitrification and Immobilization in Sur-
W73-02662 2A		face Waters, and II. Characterization of the
	Origin of Manganese Nodules of the Pacific Ocean From Radioisotope Data,	Surface Waters in the Wabash River and Three
HYDROLOGY	W73-02752 5B	Farm Ponds,
Water Resources of the Minnesota River-	# 75-02/32 3B	W73-03191 5B
Hawk Creek Watershed, Southwestern Min-	ILLINOIS	INDUS RIVER
nesota,	Physico-Chemical Limnology and Periphyton in	Nimbus 3 and 4 Observations of Snow Cover
W73-02663 7C	a Warm-Water Stream Receiving Wastewater	and Other Hydrological Features in the
Water for Texas.	Treatment Plant Effluent,	Western Himalayas,
	W73-02603 5D	W73-03134 7B
W73-03066 5B	and the second second second	Alberta Control of Street Control of Street
Remote Sensing of Snow Fields from Earth	Geology, Soils, and Hydrogeology of Volo Bog	INDUSTRIAL WASTES
Satellites.	and Vicinity, Illinois.	A New Approach for Water Reclamation -
W73-03133 7B	W73-02657 2H	Complete Treatment of Waste Water by
42	Assimilation of a Wastewater Treatment Plant	Physico-Chemical Processes,
Nimbus 3 and 4 Observations of Snow Cover	Effluent by the Asa Creek-Kaskaskia River	W73-02607 5D
and Other Hydrological Features in the	System, Moultrie County, Illinois,	Application of Biological Monitoring Systems
Western Himalayas,	W73-02887 5C	to Simulated Industrial Waste Discharge Situa-
W73-03134 7B	Via 12 - 123/27	tions.
	Salt Creek Two Stage Nitrification Plant,	W73-02617 5C
Hydrologic Conditions Viewed by the Nimbus	W73-02963 5D	
Meteorological Satellites,	and a second sec	Anaerobic Treatment of Starch Wastewaters,
W73-03135 7B	ILLIONIS	W73-02619 5D
HYDROPONICS	Microbial Modification of Ground Water,	Charles and Physics and Charles and Charles
Effects of Salt Treatments of Cotton Plants	W73-02602 5B	Chemical and Physical Factors in the Floccula-
(Gossypium hirsutum L.) on Leaf Mesophyll	IMBIBITION	tion of Metal Plating Wastes with Polyelec-
Cell Microstructure,	Rehydration of Phytochrome in Imbibing Seeds	trolytes,
W73-03081 3C	of Amaranthus retroflexus L.,	W73-02626 5D
The Asia Palana and Sc	W73-03086 2I	Control of Mercury Pollution in Sediments.
HYDROSTATIC PRESSURE	11,3-03000	W73-02632 5G
Hydrodynamic Forces on Diffuser Pipes Due	IMPACT (JETS)	Appropriate growing play in the previously a result of
to Barge Passage,	The Impact of the Jet on the Obstacle,	Pollution Hearing Sets a Southern Landmark.
W73-03032 8B	W73-03037 8B	W73-02960 5G

A

IRRIGABLE Soil Associ Irrigation, I W73-02623 IRRIGATION Irrigation o Post-Harver Rossitza Irr W73-02670 IRRIGATION Contribution of the Mai Conditions, W73-02668 Dynamics o cumulation Watering in rigation of M W73-02669

> Studies on Plants: 9. Summer Gre W73-03200

Comparativ Sierozems pacted and (In Russian) W73-03215 IRRIGATION Relationship tion Need in W73-02604 Optimum U Irrigation, W73-03229 IRRIGATION Soil Associ Irrigation, L W73-02623 IRRIGATION Man and W: W73-03090 IRRIGATION Effects of Mango (Mas W73-02698 IRRIGATION Man and Wa W73-03090 Organization W73-03106 Developmen Taking Econ liarities of I Problems, W73-03226 IRRIGATION Optimum U W73-03229

Prospects of tysh River I

Economy (F nykh vod narodnom ki W73-02812

INDUSTRIAL WASTES

Process for Detoxifying Cyanide Waste	INSECT POPULATIONS	INVERTEBRATES (FRESHWATER)
Waters, W73-02989 5D	Distribution and Seasonal Occurrence of Tabanidae along a Transect of South Carolina.	A Laboratory Study on the Toxicity of Dieldrin to Fresh Water Invertebrates,
	W73-03156 5B	W73-02695 5C
Neutralization of Ferrous Iron-Containing Acid	INSECTICIDES	INVESTMENT
Wastes, W73-02993 5D	Process of Purifying Water by Irradiating It,	Net A Profit From Farm Fish Crop,
to 11 minutes of the control of a Reservice of	W73-02982 5D	W73-02924 3E
Desalting and Purifying Water by Continuous	Organochlorine Insecticide, Herbicide and	The General Economy.
Ion Exchange, W73-02998	Polychlorinated Biphenyl (PCB) Inhibition of	W73-02929 5G
	Nakatpase in Rainbow Trout,	Discount Rates for Public Investment Under
Sites of Solid-Waste Storage and Liquid-Waste Discharge, Hartford North Quadrangle, Con-	W73-03165 5C	Uncertainty,
necticut.	Residue Reviews, Vol. 33.	W73-02942 6B
W73-03154 7C	W73-03197 5G	IODINE
Effluent and Water Quality Control of a	INSECTS	Iodine Content in the Water and Soil of Fertil-
Synthetic Fiber Pulp Mill (Abwasser Und	Distribution and Seasonal Occurrence of	ized Carp Ponds, (In Russian),
Gewaesserschutz Einer Kunstfaserzelistof-	Tabanidae along a Transect of South Carolina, W73-03156 5B	W73-02711 8I
fabrik),	W73-03156 5B	ION EXCHANGE
W73-03157 5D	INSTITUTIONS	Evaluation of Ion-Exchange Surveillance Sam- pler for Analyzing Radioactive Liquid Ef-
Surcharges and Stream Charges as Economic	Water and Our Future: An Urban Planning	fluents.
Incentives, W73-03190 SG	Manual for Local Officials, W73-02872 6B	W73-02753 5A
W73-03190 5G	"MENTAL AND THE PARTY OF THE PA	Transfer Properties and Friction Coefficients
INDUSTRIAL WATER	Public Water Supply Districts: Evaluation of a New Institution,	for Salt and Water Flow Through Clays,
Water for Industrial Development in Copiah	W73-02918 6E	W73-02829 2G
and Simpson Counties, Mississippi, W73-02651 3E	Terrandon (1973) - 1756 (Desalting and Purifying Water by Continuous
man from the	INSTRUMENTATION Stresses and Movements in Oroville Dam,	Ion Exchange,
INFORMATION EXCHANGE	W73-02849 8D	W73-02998 3A
Technology Transfer in Water Research—The Interface Between Producers and Users.		ION TRANSPORT
W73-02877 6B	Cloud Chamber Design for Water Evaporation Studies,	Transfer Properties and Friction Coefficients
The Transfer of Water Research Output by the	W73-02889 2B	for Salt and Water Flow Through Clays, W73-02829 2G
Environmental Protection Agency,		W73-02829 2G
W73-02879 6B	The Magnitude of Shear Stresses Acting on the Bottom of Open Channels by Propagating	Sorption in Flow Through Porous Media,
INHIBITORS	Surge Waves,	W73-02839 2G
Scrubbed Diesel Exhaust for Carbon Dioxide	W73-03038 8B	Sodium Export From Bean Leaves as Affected
Enrichment of Greenhouse Vegetables,	Fraunhofer Line-Depth Sensing Applied to	by the Mode of Application, W73-03073
W73-03074	Water,	W73-03073 2I
Calcium and Salt Toleration by Bean Plants,	W73-03140 5A	Evidence for Hormonal Regulation of the
W73-03094 3C	INTAKE GATES	Selectivity of Ion Uptake by Plant Cells, W73-03113
Effect of Lateral Development of Prosopis ju-	Hydrodynamic Forces on Single Intake Gates,	W 13-03113
liflora DC. Roots on Agricultural Crops,	W73-03046 8B	IONIZING RADIATION
W73-03101 3F	INTERNAL MOISTURE STRESS	Process of Purifying Water by Irradiating It, W73-02982 5D
Response of Osmotically Stressed Plants to	The Influence of Mist Irrigation on the Potato	
Growth Regulations,	 Micro-Environment and Leaf Water Relations, 	IONS
W73-03104 3C	W73-02888 3F	Salt Migration into the Atmosphere During Transpiration,
Mineral Ion Composition of Halophytic Species	INTERNAL WAVE MODES	W73-03206 2D
from Northern Utah,	The Decay and Stability of Internal Wave	IOWA
W73-03117 2I	Modes in a Multisheeted Thermocline,	Flood Control at Muscatine, Iowa (Final En-
Organochlorine Insecticide, Herbicide and	W73-02759 5G	vironmental Impact Statement).
Polychlorinated Biphenyl (PCB) Inhibition of	INTERNATIONAL WATERS	W73-03017 4A
Nakatpase in Rainbow Trout,	The Adria (Monfalcone) - Danube Basin Inter-	IRELAND
W73-03165 5C	national Waterway, W73-03230	Age and Growth of Pike in Five Irish
Metabolism of Diazinon by Fish Liver	To the Artist Colonial Colonia	Limestone Lakes, W73-02883
Microsomes,	INTERSTATE COMPACTS	the same of the last of the la
W73-03167 5C	Columbia River Interstate Compact, Politics of Negotiation.	IRON Neutralization of Ferrous Iron-Containing Acid
INLAND WATERWAYS	W73-02614 6E	Wastes,
Sewage Treatment System,	INTERSTATE RIVERS	W73-02993 5D
W73-02983 5D	Columbia River Interstate Compact, Politics of	IRON OXIDES
INPUT-OUTPUT ANALYSIS	Negotiation,	The Preparation and Oxidative Properties of
Energy Input-Output Climates of the World: A	W73-02614 6E	Ferrate Ion (FeO42-). Studies Directed Toward
Preliminary Attempt, W73-02647	INVENTORY	Its Use as a Water Purifying Agent, W73-02608 5F
	An Economic Inventory of the Miami River	CONTRACTOR AND
Systems Analysis and Water Quality Manage- ment,	and Its Economic and Environmental Role in Biscayne Bay,	IRRADIATION Process of Purifying Water by Irradiating It,
W73-02943 5G	W73-02923 4A	W73-02982 5D

IRRIGABLE LAND	ISERE RIVER	KAZAKHSTAN
Soil Associations and Land Classification for Irrigation, Lincoln County, W73-02623 3F	RU106 Distribution in a Reduced Model Simulating River Banks; Some Hydrodynamic and	Regional Hydrogeologic Investigations in Kazakhstan (Regional'nyye
	Kinetic Aspects of Its Adsorption on Sedi- ments (Repartition Du RU106 Dans Un Modele	gidrogeologicheskiye issledovaniya v Kazakh- sta
IRRIGATION Irrigation of Maize and Sunflower Grown as	Reduit Simulant Les Berges D'Une Rivi ere),	W73-02809 4B
Post-Harvest Silage Crops in the Region of	W73-02724 5B	Groundwaters of Kazakhstan and Recommen-
Rossitza Irrigation System, W73-02670 3F	ISRAEL Some Aspects of Heat and Mass Transfer in	dations Regarding Their Use in the National Economy for 1976-80 (Podzemnyye vody
IRRIGATION EFFECTS	Porous Media,	Kazakhstana i rekomendatsii po ikh ispol'-
Contribution to the Knowledge of the Growth	W73-02823 2F	zovaniyu v narodnom khozyaystve v period s
of the Maize Root System Under Irrigation	JAMES RIVER	1976 po 1980 g.), W73-02810 4B
Conditions, W73-02668 3F	Thermal Effects of the Surry Nuclear Power	AND DESCRIPTION OF THE PARTY OF
Dynamics of Nitric and Ammonia Nitrogen Ac-	Plant on the James River, Virginia; Part II: Results of Monitoring Physical Parameters of	Role of Groundwater in Maintaining the Level of Lake Balkhash (Rol' podzemnykh vod v
cumulation in the Soil, in the Interval Between	the Environment Prior to Plant Operation,	podderzhanii urovnya oz. Balkhash),
Watering in the Case of Sprinkling and Bed Irrigation of Maize,	W73-02767 5C	W73-02811 4B
W73-02669 3C	JAPAN	Prospects of Using Groundwaters Along the Ir-
Studies on the Physiological Nature of Alfalfa	Raising Salmon in the Inland Waters of Japan, (In Russian).	tysh River Near Semipalatinsk in the National Economy (Perspektivy ispol'zovaniya podzem-
Plants: 9. Effect of soil Moisture on the	W73-02899 81	nykh vod Semipalatinskogo Priirtysh'ya v
Summer Growth of Alfalfa (In Japanese), W73-03200 3F	JET BOAT	narodnom khozyaystve), W73-02812 4B
Name of the last o	Jet Boat - Tellurometer Technique for Measur-	ability deliverant and to remain them.
Comparative Characteristics of Old-Irrigated Sierozems in the Vakhsh Valley with Com-	ing Streamflow in Large Rivers, W73-02646 7B	Water Resources of the Uspenskiy Mining Dis- trict and a Technical and Economic Justifica-
pacted and Uncompacted Subarable Horizons	W73-02646 7B	tion of Their Use (Vodnyye resursy Uspen-
(In Russian), W73-03215 3F	JETS Diffusion of Thermally Busyest Water Late	skogo rudnogo poyasa i tekhniko-
AND THE PERSON NAMED IN COLUMN TO SERVICE AND ADDRESS OF THE PERSON NAMED ADDRESS OF THE PERSON NAMED ADDRESS OF THE PERSON NAMED ADDRESS	Diffusion of Thermally Buoyant Water Jets into a Moving Water Stream,	ekonomicheskoye obosnovaniye ikh ispol'- zovaniya),
RRIGATION EFFICIENCY Relationship of Plant Moisture Status to Irriga-	W73-02627 5B	W73-02814 4B
tion Need in Corn and Soybean Crops,	Turbulent Thermal Diffusion of a Slot Jet	Monitoring Groundwater Reservoirs in Pied-
W73-02604 2I	Flowing into a Moving Stream,	mont Plains of Tien Shan (Upravleniye rezhimom podzemnykh vod na predgornykh
Optimum Use of Water Resources of Basins in	W73-02895 5B	reznimom podzemnykh vod na predgornykh ravninakh Tyan' -Shanya),
Irrigation, W73-03229 3F	The Impact of the Jet on the Obstacle,	W73-02815 4B
IRRIGATION POTENTIAL	W73-03037 8B	Occurrence of Groundwater in the Piedmont
Soil Associations and Land Classification for	KANSAS	Alluvial Plain on the Northern Slope of Dzun-
Irrigation, Lincoln County, W73-02623 3F	Modeling Discharge and Conservative Water Quality in the Lower Kansas River Basin,	garian Ala Tau (Formirovaniye podzemnykh vod predgornogo shleyfa severnogo sklona Dz-
The Samuel and Samuel S	W73-02658 4A	hungarskogo Alatau),
IRRIGATION PRACTICES Man and Water: A Lesson in History,	Radioactive Waste Repository, Lyons, Kansas,	W73-02816 4B
W73-03090 3F	(Final Environmental Impact Statement).	Groundwater of the Akdala River Valley and
IRRIGATION (RING METHOD)	W73-02721 5C	Prospects of its Use as a Water-Supply Source (Podzemnyye vody doliny r. Akdala i perspek-
Effects of Irrigation Methods on Growth of	Compilation of Water Quality Data and	tivy ikh ispol'zovaniya dlya vodosnabzheniya),
Mango (Mangifera indica L.) Plants, W73-02698 3F	Parameters from Kansas Rivers and Streams, W73-02973 5A	W73-02817 4B
IRRIGATION SYSTEMS	12 Hill & St. Walderson, American Advanced A. Design	Underground Mineral Water of Alpine Regions
Man and Water: A Lesson in History,	KANSAS RIVER BASIN Modeling Discharge and Conservative Water	of Southeastern Kazakhstan (Podzemnyye mineral'nyye vody vysokogornykh rayonov
W73-03090 3F	Quality in the Lower Kansas River Basin,	Yugo-Vostochnogo Kazakhstana),
Organizational Aspects of Irrigation Systems,	W73-02658 4A	W73-02818 4B
W73-03106 3F	KARNAFULI DAM (BANGLADESH)	KENT COUNTY (DEL)
Development of Water Resources of a Basin	Damage to Karnafuli Dam Spillway, W73-02787 8B	The Availability of Ground Water in Kent County, Delaware, With Special Reference to
Taking Economic Aspects into Account: Pecu- liarities of Investigation of Practical Irrigation	Language and the second of the	the Dover Area,
Problems,	Role of Vertical Shafts in the Movement of	W73-02806 4B
W73-03226 3F	Ground Water in Carbonate Aquifers,	KENTUCKY
IRRIGATION WATER	W73-02803 2F	Role of Vertical Shafts in the Movement of Ground Water in Carbonate Aquifers,
Optimum Use of Water Resources of Basins in Irrigation.	KARST HYDROLOGY	W73-02803 2F
W73-03229 3F	Role of Vertical Shafts in the Movement of	KERULEN RIVER
IRTYSH RIVER	Ground Water in Carbonate Aquifers, W73-02803 2F	Flood Plain Vegetation of the Middle Regions
Prospects of Using Groundwaters Along the Ir-	KASKASKIA RIVER (ILL)	of the Kerulen River (From Information of the Joint Soviet-Mongolian Complex Biological Ex-
tysh River Near Semipalatinsk in the National Economy (Perspektivy ispol'zovaniya podzem-	Assimilation of a Wastewater Treatment Plant	pedition of the Academy of Science of the
nykh vod Semipalatinskogo Priirtysh'ya v	Effluent by the Asa Creek-Kaskaskia River	USSR and the Academy of Science of the MP R. (In Russian).
narodnom khozyaystve), W73-02812 4B	System, Moultrie County, Illinois, W73-02887 5C	W73-02882 21

Future Env Southwest. W73-03118 A Land-Use W73-03120 The Future Southwest, W73-03121

Public La Southwest, W73-03122

Arid Lands W73-03123

Planning of Southwest, W73-03124 LANDSLIDES Slumping o Bank, Nort W73-02799 Erosional C An Apprais W73-02957 LARGEMOU Exploitation in a Small (W73-02704 Successful Micorpteru Laboratory W73-02953 LARVAE Culture of 1 W73-02952 LAVA Origin of Ocean From W73-02752 LEAD Process an Polluted W Therein, W73-02992 LEAF ENLA Relationshi tion Need i W73-02604 LEAF GATES Hydrodyna Slot Flow o W73-03045

LEAVES
Water Loss
ous Exposs
Water Vap
W73-02925
Which Wa
Isopiestic
surements
als,
W73-03096
LEGAL ASPI
Arid Lands
W73-03123

KETTLE BOGS

the state of the s		
KETTLE BOGS	LACTATE	Bathymetric Reconnaissance of Big and Littl
Modes of Bog Development in the Ukrainian Carpathians (In Russian),	Acidity and Lactate Content in the Blood of Young Atlantic Salmon (Salmo salar L.) Ex-	Washoe Lakes, Washoe County, Nevada, W73-03138
W73-02693 4A	posed to High pCO2,	AN TOURST THE STATE OF THE STAT
	W73-03170 5C	LAMINAR FLOW
KINEMATIC WAVE THEORY	AND THE PROPERTY OF AN EXPERTMENT	A Numerical Study of the Nonlinear Lamina
Experimental Investigation of Converging	Dynamics of the Poplar Forest Associations in	Regime of Flow in an Idealised Porous Medi
Overland Flow, W73-03018 2E	River Basins of the Lake Baikal Southeastern	W73-02825
KINETICS	Shore, (In Russian), W73-02881 4A	Non-Darcian Flow of Water in SoilsLamina
Sorption in Flow Through Porous Media,	W/3-02001	Region,
W73-02839 2G	LAKE BAIKAL (USSR)	W73-02836 20
	New Data on the Fauna of Naididae	Study of Viscous Hydraulic Damping o
Concerning Velocity Distributions in Turbulent	(Oligochaeta) of Lake Baikal, W73-03016 2H	Breathing Vibrations of a Cylindrical Shell in
Flow at Porous Surfaces, W73-03059 8B	W73-03016 2H	Fluid at Rest (Etude de l'amortissemen
	LAKE BALKHASH	hydraulique visqueux des vibrations de respira
KIRGIZ SSR	Regional Hydrogeologic Investigations in	tion d'une coque cylindrique dans un fluide a
Mass Budget of the Kara-Batkak Glacier on the	Kazakhstan (Regional'nyye	repos), W73-03053
Northern Slope of the Terskey Ala-Too Range	gidrogeologicheskiye issledovaniya v Kazakh-	W 73-03033
(Byudzhet lednikov severnogo sklona khrebta Terskey Ala-Too na primere lednika Kara-Bat-	w73-02809 4B	LAMPREY
kak),	W 13-02809	Reproduction of the Caspian Lamprey in th
W73-02634 2C	Role of Groundwater in Maintaining the Level	Kura Basin Under Hydroconstruction Condi
	of Lake Balkhash (Rol' podzemnykh vod v	tions, (In Russian), W73-02684 50
Water Balance of the Kara-Batkak Glacier	podderzhanii urovnya oz. Balkhash),	W73-02684 50
Basin (Vodnyy balans lednikovogo basseyna na primere lednika Kara-Batkak).	W73-02811 4B	LAND CLASSIFICATION .
W73-02635 2C	LAKE ERIE	Soil Associations and Land Classification fo
	Troubled Waters, Lake Erie 1971,	Irrigation, Lincoln County,
Heat Balance of the Kara-Batkak Glacier Sur-	W73-02743 5B	W73-02623
face During an Ablation Season (Teplovoy	LAKE MICHIGAN	A Land-Use Classification System for Us
balans poverkhnosti lednika Kara-Batkak v period tayaniya),	The Occurrence and Possible Source of the	With Remote-Sensor Data,
W73-02638 2C	Coliform Bacteria on the Shoreline of Northern	W73-02649 71
117-02030	Lake Michigan,	Dii II-b Ei i- th
KOKEMAENJOKI DRAINAGE BASIN	W73-02606 5B	Planning our Urban Environment in the Southwest,
On the Phytoplankton of Waters Polluted by a		W73-03124 6
Sulphite Cellulose Factory,	LAKE MORPHOLOGY	
W73-02979 5C	Morphology of Glacial Lake Merzbacher and Mechanics of its Catastrophic Outburst (Mor-	LAND MANAGEMENT
KOYNA DAM (INDIA)	fologiya lednikovogo ozera Mertsbakhera i	The Relationship Between Land Use and En
Hydrodynamic Forces Caused by Unsteady	mekhanizm yego katastroficheskikh proryvov),	vironmental Protection, W73-02915
Slot Flow on Vertical Leaf Gates,	W73-02640 2C	W 13-02913
W73-03045 8B	LAKE SEDIMENTS	Ecological River Basin Management,
KUIBYSHEV RESERVOIR (USSR)	Solubilization of inorganic phosphate by bac-	W73-03092
Fish of the Kuibyshev Reservoir (In Russian),	teria isolated from upper Klamath Lake sedi-	Future Environments of Arid Regions of th
W73-03083 8I	ment,	Southwest.
The state of the s	W73-02954 5C	W73-03118 61
KURA BASIN (USSR)	I IVE TEVOVA	TO SEND BY DESCRIPTION OF THE SENTE
Reproduction of the Caspian Lamprey in the	LAKE TEXOMA Surface Phytoplankton and Some Aspects of	LAND RECLAMATION
Kura Basin Under Hydroconstruction Condi- tions, (In Russian),	the Physical-Chemical Limnology of Three	'Apollo County Park', Waste Water Reclama tion Project for the Antelope Valley Area, Lo
W73-02684 5C	Areas on Lake Texoma,	Angeles County.
	W73-03072 2H	W73-02867 51
LABORATORY TEST	LAKES	ICT HARVEY
The Use of Electrical Resistivity to Determine Porosity of Marine Sediments,	Mercury Pollution of Golf Course Lakes,	A Land-Use Classification System for Us
W73-03141 2J	W73-02615 5B	With Remote-Sensor Data.
STANDARD SALES SALES SALES SALES SALES		W73-02649 71
LABORATORY TESTS	Morphology of Glacial Lake Merzbacher and	That I be becomed the best of the
Experimental Investigation of Effects of Un-	Mechanics of its Catastrophic Outburst (Mor-	The Relationship Between Land Use and En
steady Flows on a Suomerged Cylinder, W73-03019 8B	fologiya lednikovogo ozera Mertsbakhera i mekhanizm yego katastroficheskikh proryvov),	vironmental Protection, W73-02915
W15-03019	W73-02640 2C	W 13-02913
Loss of Pressure Due to Periodic Movement of	Thought Street at Larbonite Lancert	An Economic Inventory of the Miami Rive
an Obstacle (Sur la perte de charge due a un	Role of Groundwater in Maintaining the Level	and Its Economic and Environmental Role in
obstacle en mouvement periodique),	of Lake Balkhash (Rol' podzemnykh vod v	Biscayne Bay,
W73-03020 8B	podderzhanii urovnya oz. Balkhash), W73-02811 4B	W73-02923 4/
Boundary Effects in Desaturation of Porous	4B	A Computer Simulation Model for Flood Plain
Media,	Diel Periodicity of Chlorophyll a Concentration	Development, Part 1: Land Use Planning and
W73-03064 2G	in Oregon Coastal Waters,	Benefit Evaluation,
Available Water Capacities of Zambian Soils in	W73-02970 5C	W73-02944
Relation to Pressure Plate Measurements and	Hydrologic Reconnaissance of Big and Little	The Impact of Water Development on th
Particle Size Analysis,	Soda Lakes, Churchill County, Nevada,	Ecology of River Systems,
W73-03065 2G	W73-03137 7C	W73-03068 51

Future Environments of Arid Regions of the	LEGAL ASPECTS	LIMESTONE LAKES
Southwest.	Water Resources Management in Delaware,	Age and Growth of Pike in Five Irish
W73-03118 6B	W73-02622 6B	Limestone Lakes, W73-02883
A Land-Use Plan for the Arid Southwest,	EPA, Environmental Legislation and Energy,	Marketter Ware Chief Server on
W73-03120 6B	W73-02739 5G	LIMITING FACTORS
The Future Human Occupance of the Arid	Adjudication Provisions Under the 1909 Water	Interaction of Temperature and Salinity on Sugar Beet Germination,
Southwest,	Code-Survey of Case Law and Proposals for	W73-03084 3C
W73-03121 6B	Legislative Amendment,	The state of the s
Public Land Management in the Arid	W73-02894 6E	LINCOLN COUNTY (N MEX) Soil Associations and Land Classification for
Southwest,	Ecological River Basin Management,	Irrigation, Lincoln County,
W73-03122 6B	W73-03092 6E	W73-02623 3F
Arid Lands and Their Future,	Future Environments of Arid Lands of	LINDANE
W73-03123 6B	Southwestern States,	Effect of Dissolved Salts on Water Solubility
Manager and Manage	W73-03119 6B	of Lindane,
Planning our Urban Environment in the Southwest,	The Future Human Occupance of the Arid	W73-03185 5G
W73-03124 6B	Southwest,	LINEAR PROGRAMMING
F ANDOLUDES	W73-03121 6B	Multireservoir Analysis Techniques in Water
LANDSLIDES Slumping on the Eastern Margin of the Rockall	Public Land Management in the Arid	Quantity Studies,
Bank, North Atlantic Ocean,	Southwest,	W73-02664 4A
W73-02799 2J	W73-03122 6B	Improved River Basin Utilization Through
Erosional Consequences of Timber Harvesting:	New Attitudes About Legal Protection for	Systems Analysis,
An Appraisal,	Remains of Florida's Natural Environment,	W73-02665 6A
W73-02957 2J	W73-03216 6E	Flood Control Storage Allocations by Linear
LARGEMOUTH BASS	LEGISLATION	Programming, W73-02667 4A
Exploitation of Crayfish by Largemouth Bass	EPA, Environmental Legislation and Energy,	W73-02667 4A
in a Small Ohio Pond,	W73-02739 5G	A Methodology for Estimating the Benefits to
W73-02704 8I	Future Environments of Arid Lands of	Irrigated Agriculture from Increased Accuracy in Seasonal Streamflow Forecasts,
Successful Spawning of Largemouth Bass,	Southwestern States,	W73-03130 3F
Micorpterus salmoides (Lacepede) Under	W73-03119 6B	Market Committee of the
Laboratory Conditions,	Surcharges and Stream Charges as Economic	Some Characteristics and Applications of Mathematical Programming Models in Water
W73-02953 5G	Incentives,	Resource Systems,
LARVAE	W73-03190 5G	W73-03232 6A
Culture of the Yellow Perch in the Laboratory,	LEMON-D	Programming Model of Regional Water Quality
W73-02952 5G	The Use of a Multi-Celled Apparatus for	Management,
LAVA	Anaerobic Studies of Flooded Root Systems, W73-03194 21	W73-03240 5G
Origin of Manganese Nodules of the Pacific		LIQUID METAL FAST BREEDER REACTOR
Ocean From Radioisotope Data, W73-02752 5B	LETHAL LIMIT	Fuel Cycles and the Fast Breeder Reactor,
Additional Property and a second second	Toxicity of Aluminum Hydroxide Complexes in Neutral and Basic Media to Rainbow Trout,	W73-02765 5G
LEAD	W73-02951 5C	LIQUID WASTES
Process and a Product for the Purification of Polluted Water from Heavy Metal Ions Present		Aerating Apparatus,
Therein.	An Approach to the Problem of Pollution and Fisheries.	W73-02984 5D
W73-02992 5D	W73-03163 5C	Removal of Phosphate from Waste Water,
LEAF ENLARGEMENT	PROPERTY AND THE PROPER	W73-02990 5D
Relationship of Plant Moisture Status to Irriga-	Flood Control at Muscatine, Iowa (Final En-	Neutralization of Ferrous Iron-Containing Acid
tion Need in Corn and Soybean Crops,	vironmental Impact Statement).	Wastes,
W73-02604 2I	W73-03017 4A	W73-02993 5D
LEAF GATES	LIFE HISTORY STUDIES	Limestone Neutralization of Dilute Acid Waste
Hydrodynamic Forces Caused by Unsteady	Some Ecological Notes on Lotic Dipteran	Waters.
Slot Flow on Vertical Leaf Gates,	Emergence in Prater's Creek, South Carolina,	W73-02994 5D
W73-03045 8B	W73-03162 5C	Biochemical Sewage Treatment Via High Puri-
LEAVES	LIGHT INTENSITY	ty Molecular Oxygen,
Water Loss From Leaves as Affected by Previ-	Rehydration of Phytochrome in Imbibing Seeds	W73-03004 5D
ous Exposure in an Atmosphere Saturated with Water Vapor,	of Amaranthus retroflexus L., W73-03086 21	Oxidative Waste Disposal,
W73-02925 2D		W73-03008 5D
Which Water Potential. Differences Between	The Yellow Perch Fisheries of Deer Creek	LITERATURE REVIEW
Isopiestic Thermocouple Psychrometer Mea-	Reservoir, Utah, with Notes on Parasitism by	Literature Review: Economics,
surements of Intact and Excised Plant Materi-	Ligula Intestinalis,	W73-02934 5G
als,	W73-02701 8I	LITTORELLA UNIFLORA D
W73-03096 7B	LIMESTONE	The Association of Littorella Uniflora and
LEGAL ASPECT	Neutralization of Ferrous Iron-Containing Acid	Eleocharis Acicularis in the 'Entre-Sambre-Et-
Arid Lands and Their Future,	Wastes,	Meuse,' W73-02691 2I
W73-03123 6B	W73-02995 5D	W73-02691 2I

LOADS (FORCES)

OADS (FORCES)	MAINE	An Ecological Approach to Marine Radiologi-
Forces on a Submerged Breakwater,	Annual Report of Activities During Fiscal Year	cal Monitoring At the Florida Power Corpora-
W73-03031 8B	1972.	tion Crystal River Nuclear Plant, W73-02737 5B
Hydrodynamic Wave Uplift Forces on	W73-02630 9A	W73-02737
Horizontal Slabs,	MAIZE M	MARINE ANIMALS
W73-03034 8B	Irrigation of Maize and Sunflower Grown as	An Ecological Approach to Marine Radiologi-
Hydrodynamic Forces Caused by Unsteady	Post-Harvest Silage Crops in the Region of	cal Monitoring At the Florida Power Corpora-
Slot Flow on Vertical Leaf Gates.	Rossitza Irrigation System,	tion Crystal River Nuclear Plant,
W73-03045 8B	W73-02670 3F	W73-02737 5B
A SEMBLER OF SHIP HE SHIPPING Y TOS.	MANAGEMENT	MARINE BIOLOGY
Hydrodynamic Forces on Single Intake Gates,	Integrated Management of Quantity and Quali-	The Influence of Thermal Acclimation on the
W73-03046 8B	ty of Urban Water Resources,	Relation Between Oxygen Consumption and
OCAL GOVERNMENTS	W73-02666 5G	Temperature in Littorina littorea (L.) and Myti-
Water and Our Future: An Urban Planning	Systems Analysis and Water Quality Manage-	lus edulis L.,
Manual for Local Officials,	ment,	W73-02760 5C
W73-02872 6B	W73-02943 5G	MARKETS
OCATION	A Computer Simulation Model for Flood Plain	On the Possibility of a Market for Externalities,
Location and Equipment for Oil Recovery	Development, Part 1: Land Use Planning and	W73-02933 6B
Teams in San Diego,	Benefit Evaluation,	EMITIGOS/3
W73-02910 5G	W73-02944 4A	MARKOV PROCESSES
OCKS	CONTRACTOR OF THE PARTY OF THE	Optimal Operation of Serially-Linked Water
Hydrodynamic Pressure of Nonstationary Flow	Systems Approach to Water Pollution Control -	Reservoirs, W73-02707 4A
in Canals Acting on Moored Ships,	A Discussion, W73-03224 5G	# 13-02101
W73-03033 8B	W73-03224	MARSEILLES
	An Alternative Approach for Finding Optimal	Effects of an Artificial Stream on Marine Com-
ONG TERM PLANNING	Control Rules of Reservoir Systems,	munities,
Future Environments of Arid Regions of the	W73-03231 4A	W73-03171 5C
Southwest. W73-03118 6B	MANGANESE	MASS CURVE ANALYSIS
W/3-03110 6B	Origin of Manganese Nodules of the Pacific	Multireservoir Analysis Techniques in Water
A Land-Use Plan for the Arid Southwest,	Ocean From Radioisotope Data,	Quantity Studies,
W73-03120 6B	W73-02752 5B	W73-02664 4A
The Future Human Occupance of the Arid	Land Markey and the second and the	
Southwest.	Manganese, Zinc and Copper Content in Or-	MASS SPECTROMETRY
W73-03121 6B	gans and Tissues of Carp Underyearlings, (In Russian).	Identification of Toxic Components in Oil
	W73-02884 5B	Refinery Effluents and Determination of Their
Public Land Management in the Arid	Della Halla	Effect Upon the Aquatic Biota, W73-02609 5A
Southwest, W73-03122 6B	MANGO D	W 13-02005
W/3-03122 6B	Effects of Irrigation Methods on Growth of	MASS TRANSFER
Arid Lands and Their Future,	Mango (Mangifera indica L.) Plants, W73-02698	Thermodynamic Analogy of Mass Transport
W73-03123 6B	W73-02698	Processes in Porous Media,
New Towns for the Southwest,	MANGROVE SWAMPS	W73-02819 2F
W73-03125 6B	An Ecological Study of the Soil Microfungi in a	Stationary Heat Transport by Plane Ground-
	Hawaiian Mangrove Swamp,	water Movement in a Thin or a Thick Layer,
OS ANGELES COUNTY	W73-03205	W73-02820 2F
'Apollo County Park', Waste Water Reclama-	MAPS	THE REST OF THE PARTY OF THE PA
tion Project for the Antelope Valley Area, Los Angeles County.	Location of Wells and Test Holes, Hartford	Some Aspects of Heat and Mass Transfer in
W73-02867 5D	North Quadrangle, Connecticut,	Porous Media, W73-02823 2F
and the second of the second on a first	W73-03153 7C	W73-02823
OW FLOW AUGMENTATION	Maximum Concentration of Dissolved solids in	Transfer Properties and Friction Coefficients
Integrated Management of Quantity and Quali-	Surface Water, Hartford North Quadrangle,	for Salt and Water Flow Through Clays,
ty of Urban Water Resources,	Connecticut.	W73-02829 2G
W73-02666 5G	W73-03155 7C	Sorption in Flow Through Porous Media,
UMBERING	Formand to Prater Communication and Automated	W73-02839 2G
Erosional Consequences of Timber Harvesting:	MARGINAL COSTS Cost Allocation for A Regional Pollution Treat-	20
An Appraisal,	ment System,	MASS WASTING
W73-02957 2J	W73-02937 5G	Slumping on the Eastern Margin of the Rockall
A Survey of Some Possible Effects of Logging	THE RESIDENCE OF THE PARTY OF T	Bank, North Atlantic Ocean,
on Two Eastern Vancouver Island Streams,	MARIAS RIVER BASIN	W73-02799 2J
W73-03160 4C	Improved River Basin Utilization Through	MASSACHUSETTS
LYONS (KANSAS)	Systems Analysis, W73-02665 6A	Fall River Harbor, Massachusetts and Rhode
Radioactive Waste Repository, Lyons, Kansas,	W 73-02003	Island (Draft Environmental Impact State-
(Final Environmental Impact Statement).	MARINE ALGAE	ment).
W73-02721 5C	Uptake of Ru106 by Marine Organisms in	W73-03144 8A
	Aquaria and in the Natural Environment (Ob-	MATERIAL MARKET C
MAD CREEK (IOWA)	servations Concernant les Contaminations Ex-	MATHEMATIC MODELS Eddy Diffusion Coefficients due to Instabilities
Flood Control at Muscatine, Iowa (Final Environmental Impact Statement).	perimentales et les Contaminations 'In situ' D'especes Marines Par Le Ru106,	in Internal Gravity Waves,
W73-03017 4A	W73-02717 5B	W73-02776 2E

Some Problem Water Resour Modelling, W73-03227

MATHEMATIC Sediment Yie Equation, W73-02794

Using a Digita W73-02801 Further Cor Behaviour of W73-02846

A New Tech

Mass Transfe Phase Flow, W73-02875

Systems Anament, W73-02943 Oxygen Tran Sulfite Solutio W73-02962

W73-02962

A Self-Verify
River-Basin F
W73-03183

Environments bilities, W73-03184

Systems App of Water Poll W73-03223

Some Chara Mathematica Resource Sys W73-03232

Mathematica Resources De W73-03237

MATHEMATIC Groundwater W73-02624

On the Planton homogeneous W73-02824

MATURATION Estimates of for Columbia mon and the Yield, W73-02927

MEANDERS Late-Stage M W73-02796

MEASUREME Environment December 19 W73-02709

> Tritium in In Experimenta Runoff, W73-02713

Some Problems of the Optimal Use of a Basin Water Resources on the Basis of Mathematical Modelling, Wd-Blong, 4A	Environmental Monitoring in the Vicinity of the Los Alamos Scientific Laboratory, July through December 1971. W73-02719 5B	MESQUITE Morphological Response of Two Mesquite Varieties to 2,4,5-T and Picloram, W73-03080 4A
The second secon	The Coming Technical Revolution in Meter	METABOLISM
MATHEMATICAL MODELS	Reading.	Nutrient Status and Mycorrhizal Enhancement
Sediment Yield Computed With Universal	W73-02863 7B	of Water Transport in Soybean,
Equation, W73-02794		W73-03087 3F
W13-02174	Modern Water Rates, Part II, Meter Water in	With the second of the second polynomial and
A New Technique for Estimating Recharge	Gallons.	An Effect of Water Stress on Ethylene Produc-
Using a Digital Model,	W73-02938 6C	tion by Intact Cotton Petioles,
W73-02801 4B	MECURY	W73-03112 3F
SHEGINALIAN	Process of Purifying Water by Irradiating It,	Fuldance for Marmonal Baselation of the
Further Considerations on the Dynamic	W73-02982 5D	Evidence for Hormonal Regulation of the
Behaviour of Hydraulic Turbomachinery,		Selectivity of Ion Uptake by Plant Cells, W73-03113 2I
W73-02846 8C	MELTING	W 75-05115
Mass Transfer and Chemical Reaction in Two-	Ablation of the Semenov Glacier (Tayaniye led-	Metabolism of Diazinon by Fish Liver
Phase Flow,	nika Semenova),	Microsomes,
W73-02875 5D	W73-02636 2C	W73-03167 5C
113-02013	MEMBRANE PROCESSES	METAL PIPES
Systems Analysis and Water Quality Manage-		Slotted Corrugated Metal Pipe Drains,
ment,	of Water Transport in Soybean,	W73-02659 8A
W73-02943 5G		W 13-02039
HEAD OF BRIDGE OF THE PARTY OF	The state of the s	METAL PLATING WASTES
Oxygen Transfer to Water and to Sodium		Chemical and Physical Factors in the Floccula-
Sulfite Solutions, W73-02962 5G	Porous Support Tubes for Reverse Osmosis, W73-03009	tion of Metal Plating Wastes with Polyelec-
W73-02962 5G	W73-03009 . 3A	trolytes,
A Self-Verifying Hybrid Computer Model of	MERCURY	W73-02626 5D
River-Basin Hydrology,	Mercury Pollution of Golf Course Lakes,	METALS
W73-03183 2A	20000 00000	Removal of Dissolved Oxygen from Water,
Sherowill be a distributed blancowill		W73-02988 5D
Environmental Planning and Ecological Possi-	Control of Mercury Pollution in Sediments.	W 15-02500 SD
bilities,	W73-02632 5G	Removal of Phosphate from Waste Water,
W73-03184 6G	Environmental Dynamics of Mercury,	W73-02990 5D
Control Annual to Missourie Broklama	W72 02720 CD	
Systems Approaches to Microscale Problems		Process and a Product for the Purification of
of Water Pollution Control, W73-03223 5G	Survey of the Mercury Reprocessing Industry,	Polluted Water from Heavy Metal Ions Present
W73-03223 5G	1906-1970,	Therein, W73-02992 5D
Some Characteristics and Applications of	W73-02931 5G	W 13-02372
Mathematical Programming Models in Water		Neutralization of Ferrous Iron-Containing Acid
Resource Systems,	Japanese),	Wastes,
W73-03232 6A		W73-02993 5D
	Overpret to to the AVA	METEOROLOGICAL DATA
Mathematical Models and their Use in Water		Project Fog Drops. Part 1: Investigations of
Resources Decision-Making, W73-03237 6A	Polluted Water from Heavy Metal Ions Present	Warm Fog Properties,
W73-03237 6A	Therein, W73-02992 5D	W73-02782 2B
MATHEMATICAL STUDIES	W13-02352	A Section of the Control of the Cont
Groundwater Flow in Partially Saturated Soils,	Methyl Mercury Acetate From Waters by	METEOROLOGY
W73-02624 5E	Chromatography on Chelating Polymers,	Water Balance of the Kara-Batkak Glacier
at I was the shint I was even I will be at I	W73-03179 5A	Basin (Vodnyy balans lednikovogo basseyna na
On the Plane Steady Flow Through In-	Charles Chair for Manager in the Product	primere lednika Kara-Batkak),
homogeneous Porous Media,	The Poison Chain for Mercury in the Environ- ment,	W73-02635 2C
W73-02824 2F	W73-03202 5B	Hydrologic Conditions Viewed by the Nimbus
MATTINATION (CAT MON)	117-03202	Meteorological Satellites,
MATURATION (SALMON) Estimates of Maturation and Ocean Mortality	MERCURY REPROCESSING	W73-03135 7B
for Columbia River Hatchery Fall Chinook Sal-	Survey of the Mercury Reprocessing industry,	
mon and the Effect of No Ocean Fishing or	1900-1970,	METHANE
Yield,	W73-02931 5G	Microbial Modification of Ground Water,
W73-02927	MESCALERO AREA (N MEX)	W73-02602 5B
	The Nature and Extent of Peat Deposits and	METHODOLOGY
MEANDERS	Possible Effects of Peat Mining on Manmade	Methods for the Characterization of Suspended
Late-Stage Meander Growth,	Features and Springs Near Mescalero, New	Sediment and Selected Applications for the
W73-02796 2J	Mexico,	Acquired Data,
The state of the s	W73-02661 4B	W73-02977 5B
MEASUREMENT		A Mark dalam for Parkershall B. C.
Environmental Monitoring Report: July-	MESOPHILIC BUSHES Flood Plain Vegetation of the Middle Regions	A Methodology for Estimating the Benefits to
December 1971 and 1971 Summary, W73-02709 5B		Irrigated Agriculture from Increased Accuracy in Seasonal Streamflow Forecasts.
W73-02709 5B	Joint Soviet-Mongolian Complex Biological Ex-	W73-03130 3F
Tritium in Investigation of Surface Hydrology.		3F
Experimental Determination of Coefficient of		Systems Approaches to Microscale Problems
Runoff,	R, (In Russian),	of Water Pollution Control,
W73-02713 5E	W73-02882 2I	W73-03223 5G

An Effect of tion by Intact W73-03112 MOISTURE TE Available Wa Relation to I Particle Size W73-03065 MOISTURE UP Variations in Roots of Con W73-03085 Patterns of V tion of So Presence of a W73-03114 MONITORING Application to Simulated W73-02617 Bibliography toring of Trit W73-02708 Environment December 19 W73-02709 West Valley tal Report No W73-02712 Environment the Los Ali through Dece W73-02719 **Proceedings** vironmental Power Plants W73-02732 The Terrest grams at Du McGuire Nu W73-02735 Aquatic Rad Nuclear Plan W73-02736 An Ecologic tion Crystal W73-02737 Application Heavy Meta W73-02738 Environmen Around a Ne W73-02740 Environmen Large Nucle W73-02742 Annual Rep Radiation La W73-02744

2G

Evaluation o

pler for A fluents,

W73-02753

MOISTURE STRESS

W73-02604

Relationship of Plant Moisture Status to Irriga-tion Need in Corn and Soybean Crops,

MEXICO

An Integrated System for Providing Power,	Groundwater of the Akdala River Valley and Prospects of its Use as a Water-Supply Source	On Stabilization of Fingers in a Slightly Cracked Heterogeneous Porous Medium,
Water and Food for Desert Coasts, W73-03099 3F	(Podzemnyye vody doliny r. Akdala i perspek- tivy ikh ispol'zovaniya dlya vodosnabzheniya),	W73-02830 2G
The state of the s	W73-02817 4B	On the Derivation of a Convective-Dispersion
Morphological and Anatomical Aspects of Oedema in Eggplants (Solanum melongena L.),	Underground Mineral Water of Alpine Regions	Equation by Spatial Averaging, W73-02832 2F
W73-03105 2I	of Southeastern Kazakhstan (Podzemnyye	cal Mandanine Al-the Paris Press Waltered
MAMI RIVER (FLORIDA)	mineral'nyye vody vysokogornykh rayonov Yugo-Vostochnogo Kazakhstana),	MOAPA VALLEY (NEVADA) Pediments and Terraces along the Moapa Val-
An Economic Inventory of the Miami River	W73-02818 4B	ley, Clark County, Nevada,
and Its Economic and Environmental Role in	MINING	W73-03146 2J
Biscayne Bay, W73-02923 4A	The Nature and Extent of Peat Deposits and	MOBILE LABORATORIES
	Possible Effects of Peat Mining on Manmade	A Mobile Laboratory for Monitoring Environ-
MICHIGAN Water for a Rapidly Growing Urban Communi-	Features and Springs Near Mescalero, New Mexico.	mental Pollution (In Italian), W73-03108
ty-Oakland County, Michigan,	W73-02661 4B	W73-03108
W73-02804 3D	Water Resources of the Uspenskiy Mining Dis-	MODEL STUDIES
HICROBIAL DEGRADATION	trict and a Technical and Economic Justifica-	Groundwater Flow in Partially Saturated Soils, W73-02624 5B
Microbial Modification of Ground Water,	tion of Their Use (Vodnyye resursy Uspen-	1177 111111
W73-02602 5B	skogo rudnogo poyasa i tekhniko-	Energy Input-Output Climates of the World: A Preliminary Attempt,
IICROBIAL FLOC	ekonomicheskoye obosnovaniye ikh ispol'- zovaniya),	W73-02647 2B
Microbial Modification of Ground Water,	W73-02814 4B	A COLUMN TO THE PARTY OF THE PA
W73-02602 5B	MINING DISTRICTS	Modeling Discharge and Conservative Water Quality in the Lower Kansas River Basin,
IICROORGANISMS	Water Resources of the Uspenskiy Mining Dis-	W73-02658 4A
Biogrid Unit and Method, W73-03001 5D	trict and a Technical and Economic Justifica-	Same Entensions of Linear Systems Analysis
	tion of Their Use (Vodnyye resursy Uspen- skogo rudnogo poyasa i tekhniko-	Some Extensions of Linear Systems Analysis in Hydrology.
HILK RIVER BASIN	ekonomicheskoye obosnovaniye ikh ispol'-	W73-02662 2A
Improved River Basin Utilization Through Systems Analysis.	zovaniya),	Experimental Investigation of Hydraulic
W73-02665 6A	W73-02814 4B	Transients in River-Reservoir Systems, Phase
MILWAUKEE HARBOR (WISC.)	MINNESOTA	III,
Milwaukee Diked Disposal Area, Wisconsin,	Water Resources of the Minnesota River Hawk Creek Watershed, Southwestern Min-	W73-02706 8B
(Draft Environmental Impact Statement).	nesota.	Model Tests to Study Groundwater Flows
W73-03151 5G	W73-02663 7C	Using Radioisotopes and Dye Tracers, W73-02838 2F
MINE ACIDS	Effect of an Asphalt Barrier on Water Redis-	W 73-02636 2r
Neutralization of Ferrous Iron-Containing Acid	tribution after Infiltration in Sandy Soils,	An Experiment in Computer-Assisted Super-
W73-02995 5D	W73-03189 2G	visory Control of a Water Distribution System, W73-02871 4A
	MINNESOTA RIVER-HAWK CREEK	
MINE DRAINAGE Limestone Neutralization of Dilute Acid Waste	WATERSHED (MINN)	Methods for the Characterization of Suspended Sediment and Selected Applications for the
Waters,	Water Resources of the Minnesota River- Hawk Creek Watershed, Southwestern Min-	Acquired Data,
W73-02994 5D	nesota,	W73-02977 5B
Neutralization of Ferrous Iron-Containing Acid	W73-02663 7C	Experimental Investigation of Converging
Wastes,	MISSISSIPPI	Overland Flow,
W73-02995 5D	Water for Industrial Development in Copiah	W73-03018 2E
MINERAL SPRINGS	and Simpson Counties, Mississippi, W73-02651 3E	The Miami Conservancy District Experience in
Mineral Waters Along the Eastern Edge of the Caspian Lowland (Mineral'nyye vody		the Systems Approach to Water Quality Im-
vostochnoy okrainy Prikaspiyskoy vpadiny),	MISSOURI Mercury Pollution of Golf Course Lakes,	provement, W73-03225 5G
W73-02813 4B	W73-02615 5B	for Jak and Misky May Thomas Chrys.
MINERAL WATER	Mineral (Analysis of Chan Water Bulletin	Great Lakes Simulation ModelA Decision
Mineral Waters Along the Eastern Edge of the	Missouri (Analysis of State Water Pollution Law and Comparison with Present and	W73-03234 2H
Caspian Lowland (Mineral'nyye vody	Proposed Tennessee Law),	
vostochnoy okrainy Prikaspiyskoy vpadiny), W73-02813 4B	W73-03217 6E	A New Approach to Efficiency Guarantees,
	MISSOURI RIVER BASIN	W73-02842 8C
Underground Mineral Water of Alpine Regions of Southeastern Kazakhstan (Podzemnyye	Improved River Basin Utilization Through	MOISTURE AVAILABILITY
mineral'nyye vody vysokogornykh rayonov	Systems Analysis, W73-02665 6A	Available Water Capacities of Zambian Soils in
Yugo-Vostochnogo Kazakhstana),		Relation to Pressure Plate Measurements and
W73-02818 4B	MIST IRRIGATION The Influence of Mist Irrigation on the Potato	Particle Size Analysis, W73-03065 2G
MINERALIZATION	I. Micro-Environment and Leaf Water Rela-	
Water Resources of the Uspenskiy Mining Dis-	tions,	A Hydrophilic Polymer as a Soil Amendment,
trict and a Technical and Economic Justifica-	W73-02888 3F	W73-03098 2G

W73-02888

Aquifers, W73-02791

Gravitational and Dispersive Mixing in

2F

MIXING

zovaniya),

W73-02814

tion of Their Use (Vodnyye resursy Uspenskogo rudnogo poyasa i tekhniko-ekonomicheskoye obosnovaniye ikh ispol'-

SWIMPLING DOLLAR TAXABLE COMMISSION AND ADDRESS.		
An Effect of Water Stress on Ethylene Produc-	A Mobile Laboratory for Monitoring Environ-	MULTI-RESERVOIR SYSTEMS
tion by Intact Cotton Petioles, W73-03112	mental Pollution (In Italian), W73-03108 5A	Optimal Operation of Serially-Linked Water
W73-03112 3F	W 73-03106	Reservoirs, W73-02707
MOISTURE TENSION	Environmental Monitoring Associated with	W 13-02707
Available Water Capacities of Zambian Soils in	Discharges of Radioactive Waste During 1969	MULTIPLE-PURPOSE PROJECTS
Relation to Pressure Plate Measurements and	from UKAEA Establishments. W73-03220 5B	Organizational Alternatives in Consolidating Ir-
Particle Size Analysis, W73-03065 2G	W73-03220 5B	rigation Systems,
W 73-03003	MONOMOLECULAR FILMS	W73-03107 3F
MOISTURE UPTAKE	An Expansion Cloud Chamber Study of Water	MULTIPLE PURPOSE RESERVOIRS
Variations in Sodium Uptake Along Primary	Evaporation, W73-02890 2B	Effects of Reservoir Operating Policy on
Roots of Corn Seedlings,	W 13-02070 2B	Recreation Benefits,
W73-03085 3C	MONONGAHELA RIVER (W.VA.)	W73-02618 6B
Patterns of Water Uptake and Root Distribu-	Antibodies Against Human Enteric Bacteria in	MANUFACTURE CONTRACTOR OF THE PROPERTY OF THE
tion of Soybeans (Glycine max.) in the	Brown Bullheads (Ictalurus Nebulosus,	Effect of Reservoir Drawdown on Optimal
Presence of a Water Table,	Leseuer) from Contaminated Waters, W73-02975 5C	Operation, W73-03244 4A
W73-03114 3F	#15-02515	TARREST MANAGEMENT OF THE PARTY
MONITORING	MONTANA	MULTIRESERVOIR SIMULATION MODELS
Application of Biological Monitoring Systems	Improved River Basin Utilization Through	Multireservoir Analysis Techniques in Water
to Simulated Industrial Waste Discharge Situa-	Systems Analysis, W73-02665 6A	Quantity Studies,
tions,	W 13-02003	W73-02664 4A
W73-02617 5C	River Basin Modeling, an Approach to Com-	MUNICIPAL WASTES
Bibliography on Handling, Control and Moni-	puter Simulation of the Bitterroot-Clark Fork	Salt Creek Two Stage Nitrification Plant,
toring of Tritium (Dec. 1968-Jan. 1972),	River Basin.	W73-02963 5D
W73-02708 5B	W73-02857 4A	The state of the s
MURCH CAROLINA	Performance of an Atmospheric Water	Sites of Solid-Waste Storage and Liquid-Waste
Environmental Monitoring Report: July-	Resources Research Program in the Hungry	Discharge, Hartford North Quadrangle, Con-
December 1971 and 1971 Summary, W73-02709 5B	Horse Area, Montana.	necticut, W73-03154 7C
W73-02709 5B	W73-03143 3B	W /3-03134
West Valley Reprocessing Plant. Environmen-	MORTALITY	Surcharges and Stream Charges as Economic
tal Report No. 11, 2nd Half 1971,	A Simple Technique for Detecting Effects of	Incentives,
W73-02712 5B	Toxicants or Other Stresses on a Predator-Prey	W73-03190 5G
Environmental Monitoring in the Vicinity of	Interaction,	AMIDODI O
the Los Alamos Scientific Laboratory, July	W73-03161 5C	MUSSELS The Influence of Thermal Acclimation on the
through December 1971.	MOUNTAINS	Relation Between Oxygen Consumption and
W73-02719 5B	Mass Budget of the Kara-Batkak Glacier on the	Temperature in Littorina littorea (L.) and Myti-
P	Northern Slope of the Terskey Ala-Too Range	lus edulis L.,
Proceedings of Southern Conference on En- vironmental Radiation Protection from Nuclear	(Byudzhet lednikov severnogo sklona khrebta	W73-02760 5C
Power Plants, April 21-22, 1971.	Terskey Ala-Too na primere lednika Kara-Bat- kak),	Pick of the Weibert to Bernario (In Burning)
W73-02732 5B	W73-02634 2C	Fish of the Kuibyshev Reservoir (In Russian), W73-03083
		W 73-03003
The Terrestrial Radiological Monitoring Pro- grams at Duke Power Company's Oconee and	Rate of Movement, Ablation, and Dynamics of	NAIDIDS
McGuire Nuclear Stations,	Some Glaciers of the Ak-Shiyrak Range (Skorostnoy rezhim, tayaniye i dinamika neko-	New Data on the Fauna of Naididae
W73-02735 5B	torykh lednikov massiva Ak-Shiyrak),	(Oligochaeta) of Lake Baikal,
	W73-02637 2C	W73-03016 2H
Aquatic Radiological Monitoring Browns Ferry	Commence of Considerates in the Biodesest	NATIONAL REACTOR TESTING STATION
Nuclear Plant, W73-02736 5B	Occurrence of Groundwater in the Piedmont Alluvial Plain on the Northern Slope of Dzun-	(IDAHO)
	garian Ala Tau (Formirovaniye podzemnykh	Probability of Exceeding Capacity of Flood-
An Ecological Approach to Marine Radiologi-	vod predgornogo shleyfa severnogo sklona Dz-	Control System at the National Reactor Testing
cal Monitoring At the Florida Power Corpora-	hungarskogo Alatau),	Station, Idaho, W73-02781 4A
tion Crystal River Nuclear Plant, W73-02737 5B	W73-02816 4B	W /3-02/81 4A
the street are a second	MOVEMENT	NATURAL FREEZING
Application of CF252 to the Detection of	Rate of Movement, Ablation, and Dynamics of	Precoat Vacuum Filtration and Natural-Freeze
Heavy Metals for Pollution Control,	Some Glaciers of the Ak-Shiyrak Range	Dewatering of Alum Sludge,
W73-02738 5A	(Skorostnoy rezhim, tayaniye i dinamika neko-	W73-02965 5F
Environmental Sampling for River Sediments	torykh lednikov massiva Ak-Shiyrak), W73-02637 2C	NAVASOTA RIVER DRAINAGE
Around a Nuclear Power Station,	W/3-0263/	The Composition and Distribution of the Fish
W73-02740 5B	Dynamics and Structure of the Yuzhnyy In-	Fauna of the Navasota River,
Project Definition Designation	yl'chek Glacier (Voprosy dinamiki i struktury	W73-02613 8I
Environmental Radiation Dosimetry Near Large Nuclear Power Stations,	lednika Yuzhnyy Inyl'chek),	
W73-02742 5B	W73-02639 2C	NAVIER-STOKES EQUATIONS
	Glacier Surveys by District Personnel of the	A Numerical Study of the Nonlinear Laminar
Annual Report of the Eastern Environmental	Water Survey of Canada: 1. The Victoria Glaci-	Regime of Flow in an Idealised Porous Medi-
Radiation Laboratory, January-December 1970.	er,	um, W73-02825 2F
W73-02744 5B	W73-02648 2C	
Evaluation of Ion-Exchange Surveillance Sam-	MUDFLOWS	NETHERLANDS
pler for Analyzing Radioactive Liquid Ef-	Slumping on the Eastern Margin of the Rockall	The Reciprocity Principle in Flow Through
fluents,	Bank, North Atlantic Ocean,	Heterogeneous Porous Media,
W73-02753 5A	W73-02799 2J	W73-02827 4B

The Terrestria grams at Duke McGuire Nucle W73-02735 Aquatic Radiol Nuclear Plant, W73-02736

An Ecological cal Monitoring tion Crystal Riv W73-02737

Environmental Around a Nucl W73-02740

Environmental perience Near : W73-02741

Environmental Large Nuclear W73-02742

Radioactive an bia River an Ocean, W73-02745

Sounding The W73-02764

Fuel Cycles an W73-02765

Electrical Ene Problems, Now W73-02768

Environmental Power Product W73-02774

Environmental Nuclear Power W73-02840 NUCLEAR REAL Sounding The W73-02764 Fuel Cycles an W73-02765 NUCLEAR WAS Uptake of R. Aquaria and in servations Cor perimentales of D'especes Mar W73-02717 Radioactive W (Final Environ W73-02721 Symposium of W73-02722

RU106 Distriblating River B Kinetic Aspectments (Reparti Reduit Simular W73-02724

Progress Repo Division, Env January 1972 to W73-02725

A Southern Outpost of Steppe Ravine Forest in	Sources of Nutrients in Canadarago Lake, W73-02859 5C	NON-STRUCTURAL ALTERNATIVES A Method of Comparing Forest Production
Semi Desert, (In Russian),	ARTHUR THE TOTAL BOOK IN ANTIQUES	Data to Agricultural Data in River Basin
W73-02758 4A	NEWTS Radionuclide Cycling in Natural Populations of	Planning, W73-03093 6F
ETWORK ANALYSIS	Amphibians. Annual Progress Report, June 16,	#FIGURE CONTROL OF THE ASSESSMENT OF THE PARTY OF THE PAR
An Experiment in Computer-Assisted Super-	1971 - June 15, 1972,	Organizational Aspects of Irrigation Systems,
visory Control of a Water Distribution System, W73-02871 4A	W73-02755 5C	W73-03106
	NIMBUS SATELLITES	Organizational Alternatives in Consolidating Ir-
Limestone Neutralization of Dilute Acid Waste	Hydrologic Conditions Viewed by the Nimbus	rigation Systems, W73-03107 3F
Waters,	Meteorological Satellites, W73-03135 7B	
W73-02994 5D	A SHARE THE LAW, WINDSMAN, A TORSA MARRADA.	NON-UNIFORM FLOW
Neutralization of Ferrous Iron-Containing Acid	NITRATES	Moment Characteristics of Cascades Under Nonstationary Flow Conditions,
Wastes, W73-02995 5D	Pollution Studies of the Regional Ogallala Aquifer at Portales, New Mexico.	W73-03029 8B
A TO BELLEVILLE AND CONTRACT OF THE PARTY OF	W73-02891 5B	Calculation of Generalized Hydrodynamic
EUTRON ACTIVATION ANALYSIS Instruction Manual for Oil Slick Identification	Removal of Nitrogen and Phosphorus from	Forces for Kaplan Turbine Blades Oscillating
by Trace Element Patterns Measured with	Waste Waters,	in the Liquid Flow,
Neutron Activation Analysis,	W73-03002 5D	W73-03030 8B
W73-02715 5A	Nitrate Transformations in Surface Waters; I.	NONLINEAR LAMINAR FLOW
(EVADA	A Study of Various Factors Affecting the Rates	A Numerical Study of the Nonlinear Laminar Regime of Flow in an Idealised Porous Medi-
Hydrologic Reconnaissance of Big and Little	of Denitrification and Immobilization in Sur-	um,
Soda Lakes, Churchill County, Nevada, W73-03137 7C	face Waters, and II. Characterization of the Surface Waters in the Wabash River and Three	W73-02825 2F
Bathumatria Bassansiasanas of Bis and Little	Farm Ponds,	NORTH CAROLINA
Bathymetric Reconnaissance of Big and Little Washoe Lakes, Washoe County, Nevada,	W73-03191 5B	Annual Report FY 1972.
W73-03138 7C	NITRIFICATION	W73-02628 9A
Pediments and Terraces along the Moapa Val-	Dynamics of Nitric and Ammonia Nitrogen Ac-	Inventory of Active Water Resources Research
ley, Clark County, Nevada,	cumulation in the Soil, in the Interval Between	Projects in North Carolina.
W73-03146 2J	Watering in the Case of Sprinkling and Bed Irrigation of Maize,	W73-02629 9D
NEW CASTLE COUNTY (DEL)	W73-02669 3C	Growth of the Bay Scallop: The Influence of
The Availability of Ground Water in New Cas- tle County, Delaware,	Salt Creek Two Stage Nitrification Plant,	Experimental Water Currents, W73-02702 2L
W73-02785 4B	W73-02963 5D	TOTAL DOCUMENT TOTAL
NEW HAMPSHIRE	AND THE PARTY OF T	North Carolina (Analysis of State's Water Pol- lution Law and Comparison with Present and
A Six-Year Review.	NITROGEN Determination of Optimal Proportions of	Proposed Tennessee Law),
W73-02655 9A	Nitrogen and Phosphorus Contents Used for	W73-03218 6E
NEW MEXICO	Pond Fertilization, (In Russian), W73-02681	NUCELLA LAPILLUS
Soil Associations and Land Classification for	W 13-02001	Nucella lapillus (L.) As a Predator of Edible
Irrigation, Lincoln County, W73-02623 3F	Effects of Summer Application of Water and	Cockles, W73-02703
(Objections) of Lake Rakes	Nitrogen on Fruit Quality and Flowering of Satsuma Orange Trees (In Japanese),	The state of the s
The Nature and Extent of Peat Deposits and Possible Effects of Peat Mining on Manmade	W73-02697 3F	NUCLEAR ENGINEERING
Features and Springs Near Mescalero, New	Removal of Nitrogen and Phosphorus from	Fuel Cycles and the Fast Breeder Reactor, W73-02765 56
Mexico,	Waste Waters,	III Altra man
W73-02661 4B	W73-03002 5D	NUCLEAR EXPLOSIONS Distribution of Radioactivity in and Near the
Bioassays of Quality in Water Resources of	NITROGEN COMPOUNDS	Rainier Rubble Chimney,
Major Importance to New Mexico, W73-02876 5C	Nitrogen Compound Regime in the Water and	W73-02723
	Soil of Ponds, (In Russian),	Long Term Release of Radioactivity from
Pollution Studies of the Regional Ogallala Aquifer at Portales, New Mexico,	W73-02756	Rainier Melt-Glass,
W73-02891 5B	Changes in the Peripheral Blood in Carp	W73-02727
NEW YORK	(Cyprinus Carpio L.) Under the Influence of Ammonium Liquor (Zmiany we Krwi Ob-	NUCLEAR FUEL CYCLE
Flood Control Storage Allocations by Linear	wodowej Karpis (Cyprinus Carpio L.) Pod	Fuel Cycles and the Fast Breeder Reactor, W73-02765 5G
Programming, W73-02667 4A	Wpływem Wody Amoniakalnesj,	White street a way a sure of the street of t
	W73-03158	NUCLEAR POWERPLANTS Proceedings of Southern Conference on En-
Environmental Radioactivity Measurement Ex- perience Near a Fuels Reprocessing Plant,	NON-DARCIAN FLOW	vironmental Radiation Protection from Nuclear
W73-02741 5B	Non-Darcian Flow of Water in SoilsLaminar	Power Plants, April 21-22, 1971.
Colombia of Lond 14 st recognition despite from	Region, W73-02836	W73-02732 5B
Project Fog Drops. Part 1: Investigations of Warm Fog Properties,	a Service of the serv	Evaluation of Environmental Factors Affecting
W73-02782 2B	NON-POINT SOURCE POLLUTION The Occurrence and Possible Source of the	Population Exposure,
A Computer Program for Calculating Nutrient	Coliform Bacteria on the Shoreline of Northern	W73-02733
Balances,	Lake Michigan, W73.02606	Waste Management,
W73-02858 7C	W73-02606 5B	W73-02734 5B

The Terrestrial Radiological Monitoring Pro-	Insoluble Species and Polymerization of	NYLON6 HOTT SHIP IN
grams at Duke Power Company's Oconee and McGuire Nuclear Stations,	Nitrato Complexes of Nitrosylruthenium in Sea Water (Nouvelles Etudes Sur Les Formes In-	Wet Oxidation of Nylon 6,6 by the Rotating Disk Technique,
W73-02735 5B	solubles Et Sur Les Phenomenes De	W73-03186 5D
Aquatic Radiological Monitoring Browns Ferry	Polymerisation Des Nitratocomplexes Du	OAK CREEK (ORE)
Nuclear Plant,	Nitrosylrut henium En Eau De Mer), W73-02731 5B	Bed-Load Transport in Mountain Streams,
W73-02736 5B		W73-02893 2J
An Ecological Approach to Marine Radiologi-	Evaluation of Ion-Exchange Surveillance Sam-	When the second has been been a ser-
cal Monitoring At the Florida Power Corpora-	pler for Analyzing Radioactive Liquid Ef-	OAK D
tion Crystal River Nuclear Plant,	fluents, W73-02753 5A	A Southern Outpost of Steppe Ravine Forest in Semi Desert, (In Russian).
W73-02737 5B	Reserving Oil or VA Salakages from Waller and	W73-02758 4A
Environmental Sampling for River Sediments	NUMERICAL ANALYSIS	The second of the second line in the second
Around a Nuclear Power Station,	Project Fog Drops. Part 1: Investigations of	Drought Resistance and Internal Water Balance
W73-02740 5B	Warm Fog Properties, W73-02782	of Oak Seedlings, W73-03199 2D
Environmental Radioactivity Measurement Ex-	W73-020-8 50	W73-03199 2D
perience Near a Fuels Reprocessing Plant,	A Numerical Study of the Nonlinear Laminar	OAKLAND COUNTY (MICH)
W73-02741 5B	Regime of Flow in an Idealised Porous Medi-	Water for a Rapidly Growing Urban Communi-
THE HALL DEVELOPMENT PLANS	um, W73-02825 2F	ty-Oakland County, Michigan,
Environmental Radiation Dosimetry Near	W17-04-045	W73-02804 3D
Large Nuclear Power Stations, W73-02742 5B	Problems Concerning Solution of Steady and	OCEAN SEDIMENTS
W13-021-12	Unsteady Groundwater Flow by Statistical	The Use of Electrical Resistivity to Determine
Radioactive and Stable Nuclides in the Colum-	Methods, W73-02826 2G	Porosity of Marine Sediments,
bia River and Adjacent Northeast Pacific	W 73-02826	W73-03141 2J
Ocean, W73-02745 5B	NUTRIENT BALANCES	OCEANOGRAPHY
W13-02143	A Computer Program for Calculating Nutrient	Synoptic Measurements of Currents and Sedi-
Sounding The All-In-One Nuclear Drum.	Balances,	ment Transport on the Continental Shelf. An-
W73-02764 5G	W73-02858 7C	nual Progress Report,
Fuel Cycles and the Fast Breeder Reactor,	NUTRIENT REGENERATION	W73-02716 2L
W73-02765 5G	Solubilization of inorganic phosphate by bac-	OCEANS .
	teria isolated from upper Klamath Lake sedi-	Uranium Concentration in Recent Ocean Sedi-
Electrical Energy Needs and Environmental Problems, Now and in the Future.	ment, W73-02954 5C	ments in Zones of Rising Currents,
	W13-02934	W73-02748 5B
	NUTRIENT REMOVAL	majoral Jilly and presented when money is
Environmental Effects Specific to Nuclear	Removal of Phosphate from Waste Water,	Diel Periodicity of Chlorophyll a Concentration
Power Production,	W73-02990 5D	in Oregon Coastal Waters, W73-02970 5C
W73-02774 5C	Removal of Nitrogen and Phosphorus from	W 13-02210
Environmental Benefit-Cost Analysis for	Waste Waters,	The Use of Electrical Resistivity to Determine
Nuclear Power Generation,	W73-03002 5D	Porosity of Marine Sediments,
W73-02840 6B	Municipal and Industrial Waste with Limited	W73-03141 2J
NUCLEAR REACTORS	Water Resources.	ODOR
Sounding The All-In-One Nuclear Drum.	W73-03127 5F	Production of Geosmin and 2-Exo-Hydroxy-2-
W73-02764 5G		Methylbornane by Streptomyces odorifer,
Fuel Cycles and the Fast Breeder Reactor,	Discussion of Waste Disposal in Arid Lands, W73-03129 5F	W73-02949 5A
W73-02765 5G	H13-03123	OEDEMA
	NUTRIENT REQUIREMENTS	Morphological and Anatomical Aspects of
NUCLEAR WASTES	Nutrient Status and Mycorrhizal Enhancement	Oedema in Eggplants (Solanum melongena L.),
Uptake of Ru106 by Marine Organisms in	of Water Transport in Soybean,	W73-03105 2I
Aquaria and in the Natural Environment (Ob- servations Concernant les Contaminations Ex-	W73-03087 3F	OCALI ALA AOUIEPE
perimentales et les Contaminations 'In situ'	The Influence of Low Substrate Sodium Levels	OGALLALA AQUIFER Pollution Studies of the Regional Ogallala
D'especes Marines Par Le Ru106,	Upon the Free Amino Acid Content of Cotton	Aquifer at Portales, New Mexico,
W73-02717 5B	Leaves,	W73-02891 5B
Radioactive Waste Repository, Lyons, Kansas,	W73-03089 3C	
(Final Environmental Impact Statement).	NUTRIENTS	OGALLALA FORMATION
W73-02721 5C	A Computer Program for Calculating Nutrient	An Economic Analysis of Water-Use Regula- tion in the Central Ogallala Formation,
Comparison on Bading-steen Analisa to the	Balances,	W73-02892 4B
Symposium on Radioecology Applied to the Protection of Man and His Environment,	W73-02858 7C	DE LEGISLA
W73-02722 5B	Sources of Nutrients in Canadarago Lake,	ОНЮ
SALTONIA COPATA ANNA PERMINANA MANAGAMA	W73-02859 5C	Exploitation of Crayfish by Largemouth Bass
RU106 Distribution in a Reduced Model Simulation Discon Parker Some Hudesdampris	Effectiveness of the Use of Nutrients in Food	in a Small Ohio Pond, W73-02704
lating River Banks; Some Hydrodynamic and Kinetic Aspects of Its Adsorption on Sedi-	Mixtures by Rainbow Trout, (In Russian),	11.202.104
ments (Repartition Du RU106 Dans Un Modele	W73-02896 8I	What Water and Waste Water Parameters
Reduit Simulant Les Berges D'Une Rivi ere),	Bollon of Open Cameral Marchell	Should We Measure,
W73-02724 5B	NYAMUNUS DELTA (USSR)	W73-02976 5A
Progress Report, Biology and Health Physics	Growth Characteristics, Structure and Abundance of Abramis Brama (L.) In the	The Miami Conservancy District Experience in
Division, Environmental Research Branch,	Water Passages of the Summer Diked Marshes	the Systems Approach to Water Quality Im-
January 1972 to March 31, 1972,	of the Nyamunus Delta (In Russian),	provement,
W73-02725 5C	W73-02678 5C	W73-03225 5G

OREGON Flood Profiles Oregon, Part I, W73-02660 Bed-Load Tran W73-02893 Adjudication P Code-Survey of Legislative Am W73-02894 Solubilization of teria isolated f ment, W73-02954 Diel Periodicity in Oregon Coas W73-02970 OREGON COAS Bed-Load Tran W73-02893 OREGON WATE Adjudication P Code-Survey Legislative Am W73-02894 ORGANIC COM Identification Refinery Efflu Effect Upon th W73-02609

ORGANIC PHOS A System for Phosphorus in from Chromoa W73-02968 ORGANIC WAS Oxidative Was W73-03008 ORGANOPHOSI Metabolism (Microsomes, W73-03167 OSMOSIS Transfer Prop for Salt and W W73-02829 Variations in **Roots of Corn** W73-03085 The Influence Upon the Free Leaves, W73-03089 OSWEGO RIVE Flood Control Programming, W73-02667 **OUTLETS** Hydrodynamic to Barge Passa W73-03032 OVERLAND FLO Experimental Overland Flow

W73-03018

OIL POLLUTION

OIL POLLUTION	Fuel Pier with the Aid of a Computer Simula-	OPERATING COSTS
Immediate Cost-Effective Abatement of Water	tion Model,	Catfish Production in Southeastern Arkansas:
Pollution from Navy Ships.	W73-02908 5G	Estimated Investment Requirements, Costs, and Returns, for Two Sizes of Farms,
W73-02901 5G Reduction of Oil Spills During Shipboard Fuel	The Containment and Recovery of Navy Oil	W73-02926 3E
Movement Evolutions,	SpillsA Financial Analysis, W73-02909 5G	OPERATIONS
W73-02907 5G	113-02509	Environmental Monitoring in the Vicinity of
The Continue of Name Of	Location and Equipment for Oil Recovery	the Los Alamos Scientific Laboratory, July
The Containment and Recovery of Navy Oil SpillsA Financial Analysis,	Teams in San Diego,	through December 1971. W73-02719 SR
W73-02909 5G	W73-02910 5G	W73-02719
	Removing Oil or Oil Substance from Water and	Effect of Reservoir Drawdown on Optimal
Location and Equipment for Oil Recovery	Land Areas Using Corncob Components,	Operation,
Teams in San Diego, W73-02910 5G	W73-02991 5G	W73-03244 4A
W13-02510	Posting Of State	OPSET
Eradicating Oil Slicks,	Eradicating Oil Slicks, W73-02996 5G	Application of a Digital Hydrologic Simulation
W73-02996 5G	W 13-023-50	Model to an Urbanized Watershed,
Method and Apparatus for Removing Oil and	Method and Apparatus for Removing Oil and	W73-02946 2A
Debris from Water,	Debris from Water,	OPTIMAL DEVELOPMENT PLANS
W73-02997 5G	W73-02997 5G	Integrated Management of Quantity and Quali-
Oli Water Consoling Process	Oil-Water Separating Process,	ty of Urban Water Resources,
Oil-Water Separating Process, W73-02999 5G	W73-02999 5G	W73-02666 56
W 13-02399	W13-02333	OPTIMIZATION
Method of Recovering Oil form an Oil Slick,	Method of Recovering Oil form an Oil Slick,	Flood Control Storage Allocations by Linear
W73-03007 5G	W73-03007 5G	Programming,
Oil Entrapment and Containment Watercraft,	00.5	W73-02667 4A
W73-03011 5G	Oil Entrapment and Containment Watercraft, W73-03011 5G	
A TANK OF THE PARTY OF THE PART	W73-03011 5G	Optimal Operation of Serially-Linked Water Reservoirs,
Freezing Oil Spills,	Freezing Oil Spills,	W73-02707 - 4A
W73-03013 5G	W73-03013 5G	W 13-02101
Multichamber Floating Barrier,		Effect of Brine Disposal Cost on Hyperfiltra-
W73-03015 5G	Multichamber Floating Barrier,	tion Plant Optimization,
THE RESERVE THE PERSON NAMED IN COLUMN 2 AND ADDRESS OF STREET	W73-03015 5G	W73-02914 SE
OIL RECOVERY TEAMS	OIL-WATER INTERFACES	On the Possibility of a Market for Externalities,
Location and Equipment for Oil Recovery	On Stabilization of Fingers in a Slightly	W73-02933 6B
Teams in San Diego, W73-02910 5G	Cracked Heterogeneous Porous Medium,	Testing of the second second second
W13-02510	W73-02830 2G	Systems Analysis and Water Quality Manage-
OIL REFINERY EFFLUENTS	SUM Subdepart for capeting to breathing	ment, W73-02943 56
Identification of Toxic Components in Oil	OILSEED CROPS	W 13-02-13
Refinery Effluents and Determination of Their Effect Upon the Aquatic Biota,	Salt Tolerance of Safflower Varieties	Systems Approaches to Microscale Problems
W73-02609 5A	(Carthamus tinctorius L.) During Germination, W73-03088	of Water Pollution Control,
10(0)	11 (3-03000	W73-03223 56
OIL SPILLS	OLIGOCHAETES	Some Problems of the Optimal Use of a Basin
Instruction Manual for Oil Slick Identification by Trace Element Patterns Measured with	New Data on the Fauna of Naididae	Water Resources on the Basis of Mathematical
Neutron Activation Analysis,	(Oligochaeta) of Lake Baikal,	Modelling,
W73-02715 . 5A	W73-03016 2H	W73-03227 4A
A STANDARD SECURIOR S	OOZE	Optimization of Basin Water Resources Utiliza-
Petroleum Hydrocarbons and the Sea,	Method for Determining Number of Bacteria in	tion,
W73-02866 5C	Ooze Deposits of Water Reservoirs (In Rus-	W73-03228 4A
Immediate Cost-Effective Abatement of Water	sian),	On the Optimization of the Design of Storage
Pollution from Navy Ships.	W73-03115 5A	Areas at River Dams,
W73-02901 5G	OPEN CHANNEL FLOW	W73-03239 4A
Toxicity and Spreading of Oil in Sea Water,	Diffusion of Thermally Buoyant Water Jets	MCGC ASSESSMENT OF STATE OF ST
W73-02903 5G	into a Moving Water Stream,	OPTIMUM DEVELOPMENT PLANS
THE DESIGNATION OF STREET AND ADDRESS OF THE PARTY OF THE	W73-02627 5B	Effects of Reservoir Operating Policy on Recreation Benefits,
The Vertical Movement of Oil in Seawater and	A CHARLES AND A STANK	W73-02618 6B
the Aging of Oil Slicks, W73-02904 5G	Equivalent Roughness for Shallow Channels,	
	W73-02786 8B	Discussion of Waste Disposal in Arid Lands,
Characterization and Treatment of Bilge and	Brink Depth for Trapezoidal Broad-Crested	W73-03129 SF
Ballast Water,	Weir,	ORANGE COUNTY AREA (TEX AND LA)
W73-02905 5G	W73-02788 8B	Development of Ground-Water Resources in
Oil Spill Characteristics and Statistics,		the Orange County Area, Texas and Louisiam,
W73-02906 5G	The Magnitude of Shear Stresses Acting on the Bottom of Open Channels by Propagating	1963-71,
Reduction of Oil Saille During Shiphard Duri	Surge Waves,	W73-03139 48
Reduction of Oil Spills During Shipboard Fuel Movement Evolutions,	W73-03038 8B	ORANGE D
W73-02907 5G	AND THE STATE OF THE PARTY AND ADDRESS OF THE PARTY ADDRESS OF THE PARTY AND ADDRESS OF THE PART	Effects of Summer Application of Water and
ATTYONIST SOLET HE BENEFIT OF THE STATE OF	Friction Forces of Unsteady Flows in Open	Nitrogen on Fruit Quality and Flowering of
Analysis of the Effects on Oil Spills of Fuel	Channels and Pipes, W73-03041 8B	Satsuma Orange Trees (In Japanese), W73-02697
Policy Changes and the Addition of Another	W73-03041 8B	W73-02697 3F

Flood Profiles in the Umpqua River Basin,	Neutralization of Ferrous Iron-Containing Acid	Ocean From Radioisotope Data,
Oregon, Part I, W73-02660 7C	Wastes, W73-02995 5D	W73-02752 5B
	A STATE OF THE PARTY OF THE PAR	Some Species of Phyllodocidae, Syllidae,
Bed-Load Transport in Mountain Streams, W73-02893 2J	Oxidative Waste Disposal, W73-03008 5D	Nephtyidae, Goniadidae, Apistobranchidae and Spionidae (Polychaeta) from the Northeast
Adjudication Provisions Under the 1909 Water	Wet Oxidation of Nylon 6,6 by the Rotating	Pacific Ocean, W73-03221 5B
Code-Survey of Case Law and Proposals for	Disk Technique,	The agreed would prome the ground and
Legislative Amendment, W73-02894 6E	W73-03186 5D	PAJARO VALLEY AREA (CALIF.) Geology and Ground Water of the Pajaro Val-
W73-02894 6E	OXYGEN	ley Area, Santa Cruz and Monterey Counties,
Solubilization of inorganic phosphate by bac-	The Determination of Primary Production in a	California,
teria isolated from upper Klamath Lake sedi-	Stream Using an Exact Solution to the Oxygen	W73-02653 4B
ment, W73-02954 5C	Balance Equation, W73-02971 5C	PALEOCLIMATOLOGY
	and Application of the second of	Palaeotemperature and Cohesion in Globigerina
Diel Periodicity of Chlorophyll a Concentration	OXYGEN BALANCE EQUATION	Ooze Sediment Cores From the Caribbean Sea,
in Oregon Coastal Waters, W73-02970 5C	The Determination of Primary Production in a Stream Using an Exact Solution to the Oxygen	W73-02797 2J
March Color of the Property of the Color of	Balance Equation,	Pediments and Terraces along the Moapa Val-
OREGON COASTAL RANGE	W73-02971 5C	ley, Clark County, Nevada, W73-03146 2J
Bed-Load Transport in Mountain Streams,	OXYGEN CONSUMPTION	W73-03146 2J
W73-02893 2J	The Influence of Thermal Acclimation on the	PARAMETRIC HYDROLOGY
OREGON WATER CODE (1909)	Relation Between Oxygen Consumption and	What Water and Waste Water Parameters
Adjudication Provisions Under the 1909 Water	Temperature in Littorina littorea (L.) and Myti-	Should We Measure, W73-02976 5A
Code-Survey of Case Law and Proposals for Legislative Amendment,	lus edulis L., W73-02760 5C	W 13-02910
W73-02894 6E	W73-02760 5C	PARASITISM
	OXYGEN CONSUMPTION (FISH)	The Yellow Perch Fisheries of Deer Creek Reservoir, Utah, with Notes on Parasitism by
ORGANIC COMPOUNDS	Oxygen Consumption of Larvae and Juveniles	Ligula Intestinalis,
Identification of Toxic Components in Oil Refinery Effluents and Determination of Their	of the Carp Family in Relation to Their Ecolo-	W73-02701 8I
Effect Upon the Aquatic Biota,	gy, (In Russian), W73-02682 8I	
W73-02609 5A		PARTICLE SIZE Transport Processes of Particles in Dilute
and this processors	OXYGEN DEMAND	Suspensions in Turbulent Water Flow - Phase
ORGANIC PHOSPHORUS A System for the Rapid Analysis of Organic	The Influence of Thermal Acclimation on the Relation Between Oxygen Consumption and	II,
Phosphorus in Water Samples or Fractions	Temperature in Littorina littorea (L.) and Myti-	W73-02605 8B
from Chromoatographic Columns,	lus edulis L.,	Palaeotemperature and Cohesion in Globigerina
W73-02968 5A	W73-02760 5C	Ooze Sediment Cores From the Caribbean Sea,
ORGANIC WASTES	OXYGEN LOSSES (PLANTS)	W73-02797 2J
Oxidative Waste Disposal,	Radial Oxygen Losses from Intact Rice Roots	An Investigation into the Flow Behaviour
W73-03008 5D	as Affected by Distance from the Apex,	Through Compacted Saturated Fine-Grained
ORGANOPHOSPHOROUS PESTICIDES	Respiration and Waterlogging, W73-02930 3F	Soils with Regard to Fines Content and Over a
Metabolism of Diazinon by Fish Liver	W 13-02930	Range of Applied Hydraulic Gradients, W73-02835 2G
Microsomes,	OXYGEN REQUIREMENTS	W 73-02833
W73-03167 5C	Eco-Physiological Studies on Desert Plants. III.	PATENTS
OSMOSIS	Respiration of Negatively Photoblastic Zygophyllum coccineum L. Seeds During Ger-	Activated Sludge Processing,
Transfer Properties and Friction Coefficients	mination,	W73-02981 5D
for Salt and Water Flow Through Clays,	W73-03116 2I	Process of Purifying Water by Irradiating It,
W73-02829 2G	The Influence of Harbicide 24.D.NA on	W73-02982 5D
Variations in Sodium Uptake Along Primary	The Influence of Herbicide 2,4-D-NA on Respiration and Survival of Simocephalus vetu-	Sewage Treatment System,
Roots of Corn Seedlings,	lus (O.F. Muller) (Cladocera),	W73-02983 5D
W73-03085 3C	W73-03166 5C	Aerating Apparatus,
The Influence of Low Substrate Sodium Levels	OXYGENATION	W73-02984 SD
Upon the Free Amino Acid Content of Cotton	Oxygen Transfer to Water and to Sodium	
Leaves,	Sulfite Solutions,	Apparatus for the Distillation of Sea Water, W73-02985
W73-03089 3C	W73-02962 5G	
OSWEGO RIVER BASIN	Biochemical Sewage Treatment Via High Puri-	Centrifugal, Multieffect Distillation Apparatus,
Flood Control Storage Allocations by Linear	ty Molecular Oxygen,	W73-02986 3A
Programming,	W73-03004 5D	Sewage Treatment Apparatus,
W73-02667 4A	PACIFIC OCEAN	W73-02987 5D
OUTLETS	Contemporary Sources and Geochemistry of	Removal of Dissolved Oxygen from Water,
Hydrodynamic Forces on Diffuser Pipes Due	Tritium in the Gulf of Mexico and its Distribu-	W73-02988 5D
to Barge Passage, W73-03032 8B	tive Province, W73-02730 5B	Process for Detoxifying Cyanide Waste
W 73-03032 8B	the pulse and the specific and policy off.	Waters,
OVERLAND FLOW	Radioactive and Stable Nuclides in the Colum-	W73-02989 5D
Experimental Investigation of Converging Overland Flow,	bia River and Adjacent Northeast Pacific Ocean,	Removal of Phosphate from Waste Water,
W73-03018 2E	W73-02745 5B	W73-02990 5D

ESTICIDE DEGRA Improving Water W73-02621 ESTICIDE REMO Improving Water cide Pollutants wit W73-02621 ESTICIDE RESIDI Development of Determining Residues in Wa Storage Reservoir W73-02844 Residue Reviews, W73-03197 PESTICIDE TOXIC Organochlorine Polychlorinated I Nakatpase in Rain W73-03165 Metabolism of Microsomes, W73-03167 ESTICIDES Improving Water cide Pollutants wi W73-02621 Effect of Dissolv of Lindane, W73-03185 PHILIPPINE ISLAN Gromet II--Rainfa pine Islands, W73-03149 PHOSPHATE SOLU Solubilization of teria isolated from W73-02954 PHOSPHATES Pollution Studies Aquifer at Portale W73-02891 Solubilization of teria isolated from ment, W73-02954 Removal of Phosp W73-02990 Removal of Phosp W73-03000 Removal of Nits Waste Waters, W73-03002 MOSPHORUS Determination o Nitrogen and Ph Pond Fertilization W73-02681

A System for the Phosphorus in V from Chromoatog W73-02968

PATENTS

Removing Oil or Oil Substance from Water	nd PATH OF POLLUTANTS	PEAT PRODUCTION
Land Areas Using Corncob Components,	Improving Water Quality by Removal of Pesti-	Herbivorous Fish in Ponds for Peat Production,
W73-02991	cide Pollutants with Aquatic Plants,	(In Russian), W73-02718
Process and a Product for the Purification	of W73-02621 5G	W 13-02/10
Polluted Water from Heavy Metal Ions Pres		PEDIMENTS
Therein,	W73-02624 5B	Pediments and Terraces along the Moapa Val-
W73-02992	SD	ley, Clark County, Nevada,
THE (DAY)	Diffusion of Thermally Buoyant Water Jets	W73-03146 2J
Neutralization of Ferrous Iron-Containing	into a Moving Water Stream,	TOT TOROUGH VARIETY OF THE PROPERTY OF THE PRO
Wastes,	5D W73-02627 5B	PENNSYLVANIA A Water Supply-Demand Analysis in Clinton
W73-02993	Township Office Off Salabara (Too Still Office)	County, Pennsylvania: A Study in Economic
imestone Neutralization of Dilute Acid W	ste Distribution of Radioactivity in and Near the	Hydrology,
Waters,	Rainier Rubble Chimney,	W73-02610 6D
W73-02994	5D W73-02723 5B	1175-02010
A DOMESTING ANTENNO	Results of Environmental Radioactivity Mea-	A Comparison of Public and Resource Ad-
Neutralization of Ferrous Iron-Containing	surements in the Community Countries in 1970:	ministrator Visual Perceptions of an Outdoor
Wastes,		Water-Based Recreation Area,
W73-02995	5D Air-Fallout-Water (Messwerte der Umwei- tradioaktivitat in den Landern der	W73-02612 6B
Eradicating Oil Slicks.	Gemeinschaft im Jahre 1970: Luft	The Codorus Creek Wastewater Management
W73-02996	5G Niederschlage-Wasser).	Study, Summary Report and Conclusions.
W17-501		W73-02869 SG
Method and Apparatus for Removing Oil	w73-02726 5B	W 13-02003
Debris from Water,	Long Term Release of Radioactivity from	Codorus Creek Water Quality Investigation Re-
W73-02997	SG Rainier Melt-Glass,	port. (MEX) 3000 NXTAW XOVXM
	W73-02727 SR	W73-02870 50
Desalting and Purifying Water by Continu	ous sputs and	Tolland in the well and in provide along
on Exchange,	Insoluble Species and Polymerization of	PENSTOCKS
W73-02998	3A Nitrato Complexes of Nitrosylruthenium in Sea	Moment Characteristics of Cascades Under
Dil-Water Separating Process,	Water (Nouvelles Etudes Sur Les Formes In-	Nonstationary Flow Conditions,
W73-02999	solubles Et Sur Les Phenomenes De	W73-03029 8B
13-02333	Polymerisation Des Nitratocomplexes Du	Calculation of Generalized Hydrodynamic
Removal of Phosphates from Sewage Efflue		Forces for Kaplan Turbine Blades Oscillating
W73-03000	5D W73-02731 5B	in the Liquid Flow,
	WANGE VEGYER	W73-03030 8B
Biogrid Unit and Method,	Evaluation of Environmental Factors Affecting	W 73-03030
W73-03001	5D Population Exposure,	Hydraulic Downpull Increase at a Dam Gate
	W73-02733 5B	Caused by Hydrodynamic Forces,
Removal of Nitrogen and Phosphorus f		W73-03043 8B
Vaste Waters,	The Terrestrial Radiological Monitoring Pro-	Attachi.
V73-03002	5D grams at Duke Power Company's Oconee and	PENTAERYTHRITOL
Process for Removing Contaminants f	McGuire Nuclear Stations,	Experimental Substantiation of the Maximal
Vaste-Wate:	W73-02735 5B	Permissible Content of Pentaerythritol and
W73-03003	5D An Ecological Approach to Marine Radiologi-	Xylitol in Water Bodies, (In Russian),
DESCRIPTION OF PROPERTY OF STANSAIS.	cal Monitoring At the Florida Power Cornora-	W73-03159 50
Biochemical Sewage Treatment Via High P	tion Crystal River Nuclear Plant,	PEPPER D
y Molecular Oxygen,	W73-02737 5B	Pepper Yield As Affected by
V73-03004	Death and the same to be a selected to be a selected to the se	Hydrometeorological Factors (In Russian),
Desalination,	Environmental Radioactivity Measurement Ex-	W73-02674 3F
W73-03005	A perience Near a Fuels Reprocessing Plant,	2000000
13-03003	W73-02741 5B	PERCHES
dethod of Recovering Oil form an Oil Slick	The state of the s	Culture of the Yellow Perch in the Laboratory,
V73-03007	SG Evaluation of Ion-Exchange Surveillance Sam-	W73-02952 5G
AND DESCRIPTION OF THE PARTY OF	pler for Analyzing Radioactive Liquid Ef-	PERIPHYTON
Oxidative Waste Disposal,	fluents, W73-02753	Periphyton and Phytobenthon as Indicators of
W73-03008	5D W/3-02/53	Water Quality,
Porous Support Tubes for Reverse Osmosis	Virus-Sized Particle Adsorption on Soil-Part I:	W73-02625 5B
W73-03009	3A Rate of Adsorption,	48 16 1 920 Web Street BY SELECTION OF THE
N 73-03009	W73-03177 5B	Assimilation of a Wastewater Treatment Plant
Flood Control Method and Apparatus,	Souther Solly person	Effluent by the Asa Creek-Kaskaskia River
W73-03010	4A The Poison Chain for Mercury in the Environ-	System, Moultrie County, Illinois,
Leaving Address of the Below Appleton	ment,	W73-02887 5C
Dil Entrapment and Containment Watercraf	W73-03202 5B	PERMEABILITY
W73-03011	SG THE	On the Correlation of Electrical Conductivity
Separator-Melter Unit for Desalination,	PEAK DISCHARGE	Properties of Porous Systems with Viscous
W73-03012	Flood Profiles in the Umpqua River Basin,	Flow Transport Coefficients,
many materials and the second	Otogon, I mit i,	W73-02822 2F
Freezing Oil Spills,	W73-02660 7C	
W73-03013	5G PPAR	Vertical and Horizontal Laboratory Permeabili-
	The Nature and Putent of Boat Denseits and	ty Measurements in Clay Soils,
Apparatus for Biologically Purifying Sewage		W73-02833 20
W73-03014	Features and Springs Near Mescalero, New	The Flow of Air and Water in Partly Saturated
Multichamber Floating Barrier,	Mexico,	Clay Soil,
W73-03015	5G W73-02661 4B	W73-02834 20

STICIDE DEGRADATION	Removal of Nitrogen and Phosphorus from	On the Phytoplankton of Waters Polluted by a
nproving Water Quality by Removal of Pesti- ide Pollutants with Aquatic Plants,	Waste Waters, W73-03002 5D	Sulphite Cellulose Factory, W73-02979 5C
W73-02621 5G	PHOSPHORYLASE ACTIVITY	Surface Phytoplankton and Some Aspects of
STICIDE REMOVAL	A Physiological Study on Variations of Dry	the Physical-Chemical Limnology of Three
mproving Water Quality by Removal of Pesti- ide Pollutants with Aquatic Plants,	Matter Percent of Tuber in Sweet Potatoes (In Japanese),	Areas on Lake Texoma, W73-03072 2H
W73-02621 5G	W73-02692 3F	PHYTOTOXICITY
STICIDE RESIDUES	PHOTOACTIVATION	Scrubbed Diesel Exhaust for Carbon Dioxide
Development of Analytical Procedures for Chlorinated Hydrocarbon	Rehydration of Phytochrome in Imbibing Seeds of Amaranthus retroflexus L.,	Enrichment of Greenhouse Vegetables, W73-03074 3F
Residues in Waters and Sediments From	W73-03086 2I	Salt Injury to Plants with Special Reference to
Storage Reservoirs, W73-02844 5A	PHOTOPERIODISM	Cations Versus Anions and Ion Activities, W73-03077 3C
Residue Reviews, Vol. 33.	Diel Periodicity of Chlorophyll a Concentration in Oregon Coastal Waters,	Water-Dead Represson direa,
W73-03197 5G	W73-02970 5C	PICKLE LIQUORS Neutralization of Ferrous Iron-Containing Acid
STICIDE TOXICITY	PHOTORESPIRATION	Wastes, W73-02993 SD
Organochlorine Insecticide, Herbicide and Polychlorinated Biphenyl (PCB) Inhibition of	A C-14 Assay for Photorespiration in Aquatic Plants,	(3) (3)(7)(7)(7)
Nakatpase in Rainbow Trout,	W73-02978 5C	Neutralization of Ferrous Iron-Containing Acid Wastes,
W73-03165 5C	PHOTOSYNTHESIS	W73-02995 5D
Metabolism of Diazinon by Fish Liver	Relationship of Plant Moisture Status to Irriga-	PIEDMONT ALLUVIAL PLAINS
Microsomes, W73-03167 5C	tion Need in Corn and Soybean Crops, W73-02604 2I	Occurrence of Groundwater in the Piedmont Alluvial Plain on the Northern Slope of Dzun-
STICIDES THE PROPERTY OF THE PARTY OF THE PA	Diel Periodicity of Chlorophyll a Concentration	garian Ala Tau (Formirovaniye podzemnykh
Improving Water Quality by Removal of Pesti-	in Oregon Coastal Waters,	vod predgornogo shleyfa severnogo sklona Dz- hungarskogo Alatau),
cide Pollutants with Aquatic Plants, W73-02621 5G	W73-02970 5C	W73-02816 4B
Effect of Dissolved Salts on Water Solubility	Effects of Streptomycin on the Ultrastructure of Plastids in Euglena,	PIEDMONT PLAINS
of Lindane,	W73-02972 5C	Regional Hydrogeologic Investigations in Kazakhstan (Regional'nyye
W73-03185 5G	Rehydration of Phytochrome in Imbibing Seeds	gidrogeologicheskiye issledovaniya v Kazakh-
ILIPPINE ISLANDS	of Amaranthus retroflexus L., W73-03086 21	sta W73-02809 4B
Gromet IIRainfall Augmentation in the Philip- pine Islands,		Monitoring Groundwater Reservoirs in Pied-
W73-03149	PHYSICAL ENVIRONMENT Systems Analysis and Water Quality Manage-	mont Plains of Tien Shan (Upravleniye
IOSPHATE SOLUBILIZATION	ment,	rezhimom podzemnykh vod na predgornykh ravninakh Tyan'-Shanya),
Solubilization of inorganic phosphate by bac- teria isolated from upper Klamath Lake sedi-	W73-02943 5G	W73-02815 4B
ment, A THE STANDARD BLANK NINVER ATTACK	PHYSICAL PROPERTIES Thermal Effects of the Surry Nuclear Power	PIERS
W73-02954 5C	Plant on the James River, Virginia; Part II:	Analysis of the Effects on Oil Spills of Fuel Policy Changes and the Addition of Another
HOSPHATES Pollution Studies of the Regional Ogallala	Results of Monitoring Physical Parameters of the Environment Prior to Plant Operation,	Fuel Pier with the Aid of a Computer Simula-
Aquifer at Portales, New Mexico,	W73-02767 5C	tion Model, W73-02908 5G
W73-02891 5B	The Relationship Between the Physical Proper-	PIKE
Solubilization of inorganic phosphate by bac-	ties of Underwater Sediments That Affect Bot- tom Reflection.	Age and Growth of Pike in Five Irish
teria isolated from upper Klamath Lake sedi- ment,	W73-02798 2J	Limestone Lakes, W73-02883
W73-02954 5C	PHYSICO-CHEMICAL CONDITIONS	PIKE PERCH
Removal of Phosphate from Waste Water,	Assimilation of a Wastewater Treatment Plant, Effluent by the Asa Creek-Kaskaskia River	The Breeding and Raising of the Pike Perch in
W73-02990 5D	System, Moultrie County, Illinois,	Ponds, W73-02700 81
Removal of Phosphates from Sewage Effluent, W73-03000 5D	W73-02887 5C	PIKES
Removal of Nitrogen and Phosphorus from	PHYSICOCHEMICAL PROPERTIES Physico-Chemical Limnology and Periphyton in	Effects of Hydrogen Sulfide on Fish Eggs and
Waste Waters,	a Warm-Water Stream Receiving Wastewater	Fry, W73-03164 5C
W73-03002 5D	Treatment Plant Effluent, W73-02603 5D	PIMEPHALES PROMELAS
HOSPHORUS	PHYTOPLANKTON	Identification of Toxic Components in Oil
Determination of Optimal Proportions of Nitrogen and Phosphorus Contents Used for	Peculiarities of the Phytoplankton Species	Refinery Effluents and Determination of Their Effect Upon the Aquatic Biota,
Pond Fertilization, (In Russian), W73-02681 8I	Composition of Some Forest Ponds, W73-02644 21	W73-02609 5A
		PINYON PINE TREES
A System for the Rapid Analysis of Organic Phosphorus in Water Samples or Fractions	Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy	Environmental Influence on the Pattern of Plant Communities Along the North Rim of the
from Chromoatographic Columns, W73-02968 5A	Complex, (In Rumanian), W73-02686 2I	Grand Canyon, W73-03078 2I
3A	02000	

Application of Heavy Metals f W73-02738

Chemical and E at Selected Site as, August 1968 W73-02808

Remote Sensing W73-03131

POLLUTANTS
Air Pollution fro
W73-02771

POLLUTION AB

The Use of Aqu of Acid Polluted W73-02611

Immediate Cost Pollution from 1 W73-02901

Pollution: Taxat W73-02911 The Relationshi vironmental Pro W73-02915

The General Ec W73-02929

Economic Impa try Pollution₁-A tive Summary. W73-02941

Pollution Hearin W73-02960 Engineers Score W73-02961

North Carolina lution Law and Proposed Tenne W73-03218

Texas (Analysis and Compariso Tennessee Law) W73-03219

POLLUTION CON The Relationshi vironmental Pro W73-02915

POLLUTION TAX Pollution: Taxat W73-02911

Taxation and Po W73-02935

Cost Allocation ment System, W73-02937 Surcharges and

Incentives, W73-03190 POLYCHAETES Some Species Nephtyidae, Gor

Spionidae (Poly Pacific Ocean, W73-03221

PIPE FLOW Friction Forces of Unsteady Flows in Open Channels and Pipes,	Environmental Planning and Ecological Possi- bilities, W73-03184	Scrubbed Diesel Exhaust for Carbon Dioxia Enrichment of Greenhouse Vegetables, W73-03074
W73-03041 8B	Non-Auto-de-About Total Businesses for	Martinian in Colina Matche Alexa Di-
PIPELINES Cleaning Water Mains With Foam PlugsEx-	New Attitudes About Legal Protection for Remains of Florida's Natural Environment, W73-03216 6E	Variations in Sodium Uptake Along Primary Roots of Corn Seedlings, W73-03085
-perience at Washington, D. C., W73-02862 5G	Systems Approaches to Microscale Problems of Water Pollution Control,	Salt Tolerance of Safflower Varieties
Mass Transfer and Chemical Reaction in Two- Phase Flow, W73-02875 5D	W73-03223 5G Systems Approach to Water Pollution Control -	(Carthamus tinctorius L.) During Germination, W73-03088 30 Seed Pelleting in Relation to Nodulation and
	A Discussion,	Nitrogen Fixation by Phaseolus aureus L. in a
PLANNING A Comparison of Public and Resource Ad-	W73-03224 5G	Saline Alkali Soil, W73-03097
ministrator Visual Perceptions of an Outdoor Water-Based Recreation Area,	Risk Programming: An Aid in Planning Reser- voir-Irrigation Systems,	An Effect of Water Stress on Ethylene Produc
W73-02612 6B	W73-03248 3F	tion by Intact Cotton Petioles, W73-03112
Comprehensive Survey of Elk River Basin,	PLANT DISEASES	W 75-03112
Volume II, Economic Base Study, W73-02860 6D	Morphological and Anatomical Aspects of Oedema in Eggplants (Solanum melongena L.),	PLANT TISSUES Morphological and Anatomical Aspects of
Thurston County, A Comprehensive Water and	W73-03105 21	Oedema in Eggplants (Solanum melongena L.), W73-03105
Sewerage Plan, Volume II, Water Plan. W73-02865 6D	PLANT GROWTH Contribution to the Study of the Possibilities of	PLANTS
Water Requirements of Santa Barbara County,	Introducing Dalmatian Pyrethrum (Pyrethrum Cinerariaefolium Trev.) In Serbia and	Biological Effects of Air Pollution, W73-02773
1967 to 1990, W73-02868 6D	Voyvodina: 3rd Report. The Influence of Growing Site on the Percentage of Pyrethrine s,	PLASTIC COVERING (PLANTS)
The Codorus Creek Wastewater Management	W73-02672 3F	Plastic Covering and Irrigation of Early
Study, Summary Report and Conclusions. W73-02869 5G	Seed Pelleting in Relation to Nodulation and Nitrogen Fixation by Phaseolus aureus L. in a	Potatoes, W73-02675
Water and Our Future: An Urban Planning	Saline Alkali Soil,	PLASTICS
Masual for Local Officials, W73-02872 6B	W73-03097 3C	Evaluation of Potable Water Storage Tanks, W73-02656
Media resourced subsciplinates	PLANT GROWTH REGULATORS Scrubbed Diesel Exhaust for Carbon Dioxide	Vegetable Production Under Plastic on the
A Computer Simulation Model for Flood Plain Development, Part 1: Land Use Planning and Benefit Evaluation,	Enrichment of Greenhouse Vegetables, W73-03074 3F	Desert Seacoast of Abu Dhabi, W73-03110
W73-02944 4A	Calcium and Salt Toleration by Bean Plants,	PLASTIDS
Towards a Philosophy of Planning: An In-	W73-03094 3C	Effects of Streptomycin on the Ultrastructure
vestigation into Attitudes Held by Federal Water Resource Planners,	Seed Pelleting in Relation to Nodulation and Nitrogen Fixation by Phaseolus aureus L. in a	of Plastids in Euglena, W73-02972
W73-02955 6E	Saline Alkali Soil,	PLATTE RIVER VALLEY (WYO)
An Approach for Involving Local Officials and	W73-03097 3C	Shallow Aquifers Relative to Surface Waten,
Citizens in Regional Water Quality Studies, W73-02956 5G	Response of Osmotically Stressed Plants to Growth Regulations,	North Platte River Valley, Goshen County, Wyoming,
Ecological River Basin Management,	W73-03104 3C	W73-02900
W73-03092 6E	An Effect of Water Stress on Ethylene Produc-	PLUMES
A Method of Comparing Forest Production Data to Agricultural Data in River Basin	tion by Intact Cotton Petioles, W73-03112 3F	A Method for Calculating the Size of Cooling Tower Plumes, W73-02763 30
Planning,	PLANT GROWTH SUBSTANCES	THE RESIDENCE OF THE PARTY OF T
W73-03093 6F	Evidence for Hormonal Regulation of the Selectivity of Ion Uptake by Plant Cells,	Process for Detoxifying Cyanide Waste
Organizational Alternatives in Consolidating Irrigation Systems,	W73-03113 21	Waters, W73-02989
W73-03107 3F	PLANT MORPHOLOGY	And the second of the State of
Future Environments of Arid Lands of	Morphological and Anatomical Aspects of Oedema in Eggplants (Solanum melongena L.),	Changes in the Peripheral Blood in Cap (Cyprinus Carpio L.) Under the Influence of
Southwestern States, W73-03119 6B	W73-03105 2I	Ammonium Liquor (Zmiany we Krwi Ob- wodowej Karpis (Cyprinus Carpio L.) Pol
A Land-Use Plan for the Arid Southwest, W73-03120 6B	PLANT PHYSIOLOGY Fine Structure of Swarmers of Cladophora and	Wplywem Wody Amoniakalnesj, W73-03158
Planning our Urban Environment in the	Chaetomorpha. III. Wall Synthesis and Development,	POLAND
Southwest,	W73-02966 · 5C	Peculiarities of the Phytoplankton Species Composition of Some Forest Ponds,
W73-03124 6B	A C-14 Assay for Photorespiration in Aquatic	W73-02644
New Towns for the Southwest, W73-03125 6B	Plants, W73-02978 5C	POLLUTANT IDENTIFICATION Instruction Manual for Oil Slick Identification
Perspectives and Goals for Water Resource Planning, W73-03182 6B	Sodium Export From Bean Leaves as Affected by the Mode of Application, W73-03073	by Trace Element Patterns Measured with Neutron Activation Analysis, W73-02715

SU-40

Application of CF252 to the Detection Heavy Metals for Pollution Control,	n of	POLYCHLORINATED BIPHENYLS Organochlorine Insecticide, Herbicide and	A Numerical Study of the Nonlinear Lamina Regime of Flow in an Idealised Porous Med
W73-02738	5A	Polychlorinated Biphenyl (PCB) Inhibition of Nakatpase in Rainbow Trout,	um, W73-02825
Chemical and Bacteriological Quality of V		W73-03165 5C	TE STATE OF THE PERSON NAMED IN THE PERSON NAM
at Selected Sites in the San Antonio Area, as, August 1968-April 1972,	Tex-	BOLVEL BOTROL WERE	On the Flow of Two Immiscible Fluids in Fra
as, August 1908-April 1972, W73-02808	5B	POLYELECTROLYTES Chemical and Physical Factors in the Floccula-	tured Porous Media, W73-02828
Remote Sensing of Environmental Pollution	m.	tion of Metal Plating Wastes with Polyelec-	On Carbillantian of Pinner 'in a Clintal
W73-03131	5A	trolytes, W73-02626 5D	On Stabilization of Fingers in a Slight Cracked Heterogeneous Porous Medium,
		W 75-02020	W73-02830 2
OLLUTANTS Air Pollution from Combustion Products,		POLYMER	Findle Coyang, and Jugatest of Lasty
W73-02771	5C	Rotational Stability in Dilute Polymer Solu-	The Tensor Character of the Dispersion Coeff
		tions, W73-02874 2E	cient in Anisotropic Porous Media, W73-02831
OLLUTION ABATEMENT	tation	the same of the sa	VANGURARTAW GARRETON
The Use of Aquatic Plants in the Rehabilit of Acid Polluted Streams,	tation	POLYMER CONCRETES	On the Derivation of a Convective-Dispersion
W73-02611	5G	Concrete-Polymer MaterialsFourth Topical	Equation by Spatial Averaging,
		Report, W73-02845 8F	W73-02832
Immediate Cost-Effective Abatement of V Pollution from Navy Ships.	Water	the first testing and the first testing and the	An Investigation into the Flow Behavior
W73-02901	5G	POLYMERS	Through Compacted Saturated Fine-Graine
	1	Removal of Phosphates from Sewage Effluent,	Soils with Regard to Fines Content and Over
Pollution: Taxation or Purification,	-	W73-03000 5D	Range of Applied Hydraulic Gradients,
W73-02911	5D	A Hydrophilic Polymer as a Soil Amendment,	W73-02835
The Relationship Between Land Use an	d En-	W73-03098 2G	Non-Darcian Flow of Water in Soils-Lamin
vironmental Protection,		PONDEROSA PINE TREES	Region,
W73-02915	4A	Environmental Influence on the Pattern of	W73-02836
The General Economy.		Plant Communities Along the North Rim of the	Sorption in Flow Through Porous Media,
W73-02929	5G	Grand Canyon,	W73-02839
Francis Impact of Anticipated Bones I		W73-03078 2I	As despositive or year, miles
Economic Impact of Anticipated Paper I try Pollution _T -Abatement Costs, Part I: E		PONTOPOREIA AFFINIS	Mechanical Action of Non-Stationary Flow
tive Summary.	ACCU-	Culture, Reproduction, and Temperature	Water on Porous Bodies and Through Stru- tures,
W73-02941	5G	Tolerance of Pontoporeia affinis in the Labora-	W73-03042
Pollution Hearing Sets a Southern Landma	ark	tory,	APPEN CYCLE CO.
W73-02960	5G	W73-03168 5C	Concerning Velocity Distributions in Turbule
MEDITAL OF LEGISLATION CONTRACTOR		POPLAR D	Flow at Porous Surfaces, W73-03059
Engineers Score Federal Pollution Tactics		Dynamics of the Poplar Forest Associations in	W 73-03039
W73-02961	5G	River Basins of the Lake Baikal Southeastern	Boundary Effects in Desaturation of Poro
North Carolina (Analysis of State's Water	r Pol-	Shore, (In Russian), W73-02881 4A	Media,
lution Law and Comparison with Presen	at and	W73-02881 4A	W73-03064
Proposed Tennessee Law),	cm.	POPULATION	PORT WASHINGTON HARBOR (WISC.)
W73-03218	6E	Proceedings of Southern Conference on En-	Milwaukee Diked Disposal Area, Wisconsi
Texas (Analysis of State Water Pollution		vironmental Radiation Protection from Nuclear Power Plants, April 21-22, 1971.	(Draft Environmental Impact Statement).
and Comparison with Present and Pro	posed	W73-02732 5B	W73-03151
Tennessee Law), W73-03219	6E	The State of the S	PORTALES (NMEX)
W/3-03219	OE	Evaluation of Environmental Factors Affecting	Pollution Studies of the Regional Ogalla
POLLUTION CONTROL		Population Exposure, W73-02733 5B	Aquifer at Portales, New Mexico,
The Relationship Between Land Use an	d En-	W73-02733 5B	W73-02891
vironmental Protection, W73-02915	44	POROSITY	PORTULACA OLERACEA D
#15-02515	4/1	On the Correlation of Electrical Conductivity	Germination Behaviour of a Weed and Thr
POLLUTION TAXES (CHARGES)		Properties of Porous Systems with Viscous Flow Transport Coefficients,	Related Crop Plants Under Various Conditio
Pollution: Taxation or Purification,	40	W73-02822 2F	of Soil Water Content and Temperature,
W73-02911	5D	shows will-easy to section to succeed the	W73-02673
Taxation and Pollution-Some Comments,		The Use of Electrical Resistivity to Determine	POTABLE WATER
W73-02935	5G	Porosity of Marine Sediments, W73-03141 2J	Evaluation of Potable Water Storage Tanks,
Cost Allocation for A Regional Pollution	Treat-	#73-03141	W73-02656
ment System,		POROUS MEDIA	
· W73-02937	5G	Thermodynamic Analogy of Mass Transport	Influence of Temperature on Taste Intensi and Degree of Liking of Drinking Water,
Surcharges and Stream Charges as Eco	nomic	Processes in Porous Media, W73-02819 2F	W73-02779
Incentives,		77-02017	IN SECURITY PRODUCES AND ARRESTS.
W73-03190	5G	On the Correlation of Electrical Conductivity	An Epidemiological Study of the Effect
		Properties of Porous Systems with Viscous	Fluorides in Drinking Water on the Frequen of Slipped Capital Femoral Epiphysis,
Some Species of Phyllodocidae, Syl	llidae.	Flow Transport Coefficients, W73-02822 2F	W73-03071
Nephtyidae, Goniadidae, Apistobranchida		11.7-02022 ZF	
Spionidae (Polychaeta) from the Nor		On the Plane Steady Flow Through In-	Quality of the Water Used for Human Co
Pacific Ocean,	-	homogeneous Porous Media,	sumption (In French), W73-03204
W73-03221	5B	W73-02824 2F	11 13 03 20 1

5B

POTATO

POTATO	Amplitude-Dependent Frequency of An Oscil-
The Influence of Mist Irrigation on the Potato I. Micro-Environment and Leaf Water Rela-	lating Cylinder in a High-Velocity Flow, W73-03026 8B
tions, W73-02888 3F	Accelerated Motion of a Sphere in an Oscillat-
	ing Fluid,
POTATO D The Effect of Drought on Potato Yields in the	al-Bank a Stay on that leavest becale brokens
Ukrainian SSR (In Russian),	PREY FISH A Simple Technique for Detecting Effects of
W73-02690 3F	Toxicants or Other Stresses on a Predator-Prey
POTATOES D	Interaction,
Plastic Covering and Irrigation of Early	W73-03161 SC
Potatoes, W73-02675 3F	PRICES
POTENTIAL WATER SUPPLY	A New Theory of Pricing and Decision-Making for Public Investment,
The Warwickshire Avon: A Case Study of	W73-02917 6B
Water Demands and Water Availability in an	PRIMARY PRODUCTIVITY
Intensively Used River System, W73-03103 6D	Columbia River Effects in the Northeast
An large seen into the Flow Balanton	Pacific: Biological Studies. Progress Report, July 1971-June 1972.
PRE-IMPOUNDMENT Pre-Impoundment Boating Activity in the	W73-02750 5B
Saylorville Reservoir Area,	The Determination of Primary Production in a
W73-02912 6B	Stream Using an Exact Solution to the Oxygen
PRECIPITATION	Balance Equation, W73-02971 5C
Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed,	
W73-02946 2A	Ecology of Yellowstone Thermal Effluent Systems: Net Primary Production and Species
PRECIPITATION (ATMOSPHERIC)	Diversity of a Successional Blue-Green Algal
Pepper Yield As Affected by	Mat,
Hydrometeorological Factors (In Russian),	W73-02980 5C
W73-02674 3F	PROBABILITY
Spatial Variation of Rainfall Spectra in South	Patterns of Drainage Areas With Random Topology.
Africa, W73-03100 2B	W73-03075 4A
Eliza M. Poscous Santament	Two Models for Horton's Law of Stream Num-
Performance of an Atmospheric Water Resources Research Program in the Hungry	bers, W73-03079 4A
Horse Area, Montana.	
W73-03143 3B	A Methodology for Estimating the Benefits to Irrigated Agriculture from Increased Accuracy
PREDATION	in Seasonal Streamflow Forecasts,
A Simple Technique for Detecting Effects of Toxicants or Other Stresses on a Predator-Prey	W73-03130 3F
Interaction,	PRODUCTIVITY (FISH)
W73-03161 5C	Number of Commercial Fish in the Volgograd Reservoir and Measures for Increasing Their
PREDATOR-PREY RELATIONSHIP	Productivity, (In Russian),
Nucella lapillus (L.) As a Predator of Edible Cockles,	W73-03172 8I
W73-02703 2L	PRODUCTIVITY (INSERTS)
PRESSURE	Studies on the Productivity of the Ponds of Upper Belgium: The Biology of Limnephilus
Experimental Study of the Structure of Turbu-	lunatus Curtis (Trichoptera),
lent Boundary Layers in Incompressible Fluids	W73-02689 2I
in the Presence of a Longitudinal Pressure Gradient.	PROGRESSIVE TAXES
W73-03061 8B	An Economic Analysis of Water-Use Regula-
PRESSURES	tion in the Central Ogallala Formation, W73-02892 4B
Flow-Induced Dynamic Pressures on Square-	
Section Cylinders, W73-03022 8B	PROJECT LIFE Examples of the Internal Condtions of Some
Age of the Land of the State of	Old Earth Dams,
Drag Coefficient and Turbulence Characteristics.	W73-02841 8A
W73-03023 8B	PROJECT PLANNING
Wake Dynamics of Two-Dimensional Struc-	Community Values: A Strategy for Project Planning.
tures in Confined Flows,	W73-02854 6B
W73-03024 8B	PROJECTIONS
The Frequency of Oscillating Forces Acting on	Groundwaters of Kazakhstan and Recommen-
Bluff Cylinders in Constricted Passages, W73-03025 8B	dations Regarding Their Use in the National Economy for 1976-80 (Podzemnyye vody
00	account to the control of the contro

Amplitude-Dependent Frequency of An Oscil-	K
lating Cylinder in a High-Velocity Flow, W73-03026	19
	W
Accelerated Motion of a Sphere in an Oscillat- ing Fluid,	U.
W73-03028	tal
REY FISH	10
A Simple Technique for Detecting Effects of Toxicants or Other Stresses on a Predator-Prey	PRO
Interaction,	Pr
W73-03161 5C	W
RICES	A
A New Theory of Pricing and Decision-Making for Public Investment,	19 W
W73-02917	
PRIMARY PRODUCTIVITY	W
Columbia River Effects in the Northeast Pacific: Biological Studies. Progress Report,	W
July 1971-June 1972.	A
W73-02750 5B	W
The Determination of Primary Production in a	T
Stream Using an Exact Solution to the Oxygen Balance Equation,	to
W73-02971 5C	
Ecology of Yellowstone Thermal Effluent	PSY
Ecology of Yellowstone Thermal Effluent Systems: Net Primary Production and Species	Is
Diversity of a Successional Blue-Green Algal Mat,	su al
W73-02980 5C	W
PROBABILITY	PUB
Patterns of Drainage Areas With Random	P
Topology, W73-03075 4A	.W
Two Models for Horton's Law of Stream Num-	
bers,	PUB
W73-03079 4A	P
A Methodology for Estimating the Benefits to Irrigated Agriculture from Increased Accuracy	W
in Seasonal Streamflow Forecasts,	Pi
W73-03130 3F	vi Pe
PRODUCTIVITY (FISH)	W
Number of Commercial Fish in the Volgograd Reservoir and Measures for Increasing Their	H
Productivity, (In Russian),	W
W73-03172 8I	В
PRODUCTIVITY (INSERTS) Studies on the Productivity of the Ponds of	V
Studies on the Productivity of the Ponds of Upper Belgium: The Biology of Limnephilus	D
lunatus Curtis (Trichoptera), W73-02689 2I	M
	W
PROGRESSIVE TAXES An Economic Analysis of Water-Use Regula-	P
tion in the Central Ogallala Formation,	fo
W73-02892 4B	W
PROJECT LIFE	P
Examples of the Internal Condtions of Some Old Earth Dams,	P
W73-02841 8A	W
PROJECT PLANNING	PUI
Community Values: A Strategy for Project Planning,	U
W73-02854 6B	W

zovaniyu v narodnom khozyaystve v period; 1976 po 1980 g.), W73-02810
U. S. Deepwater Port StudyThe Environmental and Ecological Aspects of Deepwater Ports. W73-03136
PROJECTS Inventory of Active Water Resources Researd Projects in North Carolina. W73-02629 90
Annual Report of Activities During Fiscal Year 1972. W73-02630
Water Research at the University of Connecticut.
W73-02631 9/ A Six-Year Review. W73-02655 9/
The Importance of a Practical Research Input to Water Resources Development, W73-02878
PSYCHROMETERS Which Water Potential. Differences Between Isopiestic Thermocouple Psychrometer Measurements of Intact and Excised Plant Materials, W73-03096 73
PUBLIC ATTITUDES Public Attitudes Toward Reuse of Reclaims Water,
W73-02601 50
PUBLIC HEALTH Symposium on Radioecology Applied to the Protection of Man and His Environment, W73-02722
Proceedings of Southern Conference on E- vironmental Radiation Protection from Nucles Power Plants, April 21-22, 1971. W73-02732
Health Related Problems in Arid Lands. W73-03126
Biologic Parameters in Water Transmission of Viruses,
W73-03173
Detection of Viruses in Water: A Review of Methods and Application, W73-03174
Progress in the Development of an Apparatus for Concentration of Viruses From Large Volumes of Water, W73-03175 54
Perspectives and Goals for Water Resource Planning, W73-03182
PUBLIC INVESTMENTS Discount Rates for Public Investment Undar Uncertainty, W73-02942
PUBLIC PARTICIPATION An Approach for Involving Local Officials and Citizens in Regional Water Quality Studies, W73-02956 50

azakhstana i rekomendatsii po ikh ispoj. PUBLICATIONS Bibliography or toring of Tritium W73-02708 Literature Revie W73-02934 FULP AND PAPE Economic Impa try Pollution--A tive Summary. W73-02941 PULP MILL Multi-Disciplina Relationships: A Oregon, W73-02921 PULP WASTES Multi-Disciplina Relationships: A Oregon, W73-02921 On the Phytopla Sulphite Cellulo W73-02979 Effluent and Synthetic Fibe Gewaesserschut W73-03157 PUMPING Cleaning Water perience at Was W73-02862 PYRETHRUM CIT Contribution to Introducing Pyr In Servia and V W73-02671

PYRROPHYTA Surface Phytop the Physical-Cl Areas on Lake 7 W73-03072

West Valley Re tal Report No. 1 W73-02712

Environmental : the Los Alamo through Decemb W73-02719

IMDIATION CON Application of Heavy Metals fo W73-02738

MDIATION SAFE Environmental Power Productio W73-02774

UBLICATIONS Bibliography on Handling, Control and Moni-	RADIOACTIVE WASTE DISPOSAL Radioactive Waste Repository, Lyons, Kansas,	ments (Repartition Du RU106 Dans Un Modele Reduit Simulant Les Berges D'Une Rivi ere),
toring of Tritium (Dec. 1968-Jan. 1972),	(Final Environmental Impact Statement).	W73-02724 5B
W73-02708 5B	W73-02721 5C	Progress Report, Biology and Health Physics
Literature Review: Economics,	Waste Management,	Division, Environmental Research Branch,
W73-02934 5G	W73-02734 5B	January 1972 to March 31, 1972,
HTER-ETW.	A.S	W73-02725 5C
ULP AND PAPER INDUSTRY	Aquatic Radiological Monitoring Browns Ferry	of Mallon of Donney Park Policies
Economic Impact of Anticipated Paper Indus-	Nuclear Plant,	Long Term Release of Radioactivity from
try PollutionAbatement Costs, Part I: Execu-	W73-02736 5B	Rainier Melt-Glass,
tive Summary.	Radioactive and Stable Nuclides in the Colum-	W73-02727 5B
W73-02941 5G	bia River and Adjacent Northeast Pacific	B-41
ULP MILL	Ocean,	Radionuclide Cycling in Natural Populations of
Multi-Disciplinary Study of Water Quality	W73-02745 5B	Amphibians. Annual Progress Report, June 16,
Relationships: A Case Study of Yaquina Bay,	PERSONAL PROPERTY OF THE PROPE	1971 - June 15, 1972, W73-02755 5C
Oregon,	Environmental Monitoring Associated with	W73-02755
W73-02921 5C	Discharges of Radioactive Waste During 1969	RADIOACTIVITY TECHNIQUES
AND THE PERSON SHEDWARD WINE CO.	from UKAEA Establishments.	Ecological Techniques Utilizing Radionuclides
ULP WASTES	W73-03220 5B	and Ionizing Radiation. A Selected Bibliog-
Multi-Disciplinary Study of Water Quality	RADIOACTIVE WASTES	raphy,
Relationships: A Case Study of Yaquina Bay,		W73-02746 5B
Oregon,	Environmental Effects Specific to Nuclear	Animal Compiletion and American MC Tradition-
W73-02921 5C	Power Production, W73-02774 SC	RADIOECOLOGY
On the Phytoplankton of Waters Polluted by a	W73-02774 5C	Ecological Techniques Utilizing Radionuclides
Sulphite Cellulose Factory,	Environmental Monitoring Associated with	and Ionizing Radiation. A Selected Bibliog-
W73-02979 5C	Discharges of Radioactive Waste During 1969	raphy,
The state of the s	from UKAEA Establishments.	W73-02746 5B
Effluent and Water Quality Control of a	W73-03220 5B	B A DIGIGOROPEO
Synthetic Fiber Pulp Mill (Abwasser Und	EXCHANGE ADMINISTRATION OF THE PROPERTY OF THE	RADIOISOTOPES
Gewaesserschutz Einer Kunstfaserzelistof-	RADIOACTIVE WELL LOGGING	Environmental Monitoring Report: July-
fabrik),	The Use of Gamma Logs in Determining the	December 1971 and 1971 Summary, W73-02709
W73-03157 5D	Character of Unconsolidated Sediments and	W73-02709 5B
MOCHEW MARKET	Well Construction Features, W73-02802 4B	Tritium in Investigation of Surface Hydrology.
PUMPING	W 73-02802 4B	Experimental Determination of Coefficient of
Cleaning Water Mains With Foam Plugs-Ex-	RADIOACTIVITY	Runoff,
perience at Washington, D. C.,	Bibliography on Handling, Control and Moni-	W73-02713 5B
W73-02862 5G	toring of Tritium (Dec. 1968-Jan. 1972),	to property to the second of
WRETHRUM CINERARIAEFOLIUM D	W73-02708 5B	Environmental Radiation Dosimetry Near
Contribution to the Study of the Possibilities of		Large Nuclear Power Stations,
Introducing Pyrethrum Cinerariaefolium Trev.	Tritium and Its Effects in the Environment - A	W73-02742 5B
In Servia and Voyvodina: Second Report,	Selected Literature Survey.	
W73-02671 3F	W73-02720 5C	Ecological Techniques Utilizing Radionuclides
	Results of Environmental Radioactivity Mea-	and Ionizing Radiation. A Selected Bibliog-
Contribution to the Study of the Possibilities of	surements in the Community Countries in 1970:	raphy, W73-02746 5B
Introducing Dalmatian Pyrethrum (Pyrethrum	Air-Fallout-Water (Messwerte der Umwel-	W73-02746 5B
Cinerariaefolium Trev.) In Serbia and	tradioaktivitat in den Landern der	Origin of Manganese Nodules of the Pacific
Voyvodina: 3rd Report. The Influence of	Gemeinschaft im Jahre 1970: Luft	Ocean From Radioisotope Data,
Growing Site on the Percentage of Pyrethrine s,	Niederschlage-Wasser).	W73-02752 5B
W73-02672 3F	W73-02726 5B	Topical Major India
PYRROPHYTA		Radionuclide Cycling in Natural Populations of
Surface Phytoplankton and Some Aspects of	The Terrestrial Radiological Monitoring Pro-	Amphibians. Annual Progress Report, June 16,
the Physical-Chemical Limnology of Three	grams at Duke Power Company's Oconee and	1971 - June 15, 1972,
Areas on Lake Texoma,	McGuire Nuclear Stations,	W73-02755 5C
W73-03072 2H	W73-02735 5B	
Were Learney at the University of Course	Application of CF252 to the Detection of	RADON
RADIATION	Heavy Metals for Pollution Control,	Underground Mineral Water of Alpine Regions
West Valley Reprocessing Plant. Environmen-	W73-02738 5A	of Southeastern Kazakhstan (Podzemnyye
tal Report No. 11, 2nd Haif 1971,		mineral'nyye vody vysokogornykh rayonov Yugo-Vostochnogo Kazakhstana).
W73-02712 5B	Environmental Sampling for River Sediments	W73-02818 4B
Environmental Monitoring in the Vicinity of	Around a Nuclear Power Station,	45
the Los Alamos Scientific Laboratory, July	W73-02740 5B	RAINBOW TROUT
through December 1971.	RADIOACTIVITY EFFECTS	Effectiveness of the Use of Nutrients in Food
W73-02719 5B	Low Level Chronic Irradiation of Salmon. An-	Mixtures by Rainbow Trout, (In Russian),
White It appropriately provide to be adout the	nual Progress Report.	W73-02896 8I
IMPLATION CONTROL	W73-02714 5C	
Application of CF252 to the Detection of	ACTUAL DESCRIPTION OF THE PARTY	Toxicity of Aluminum Hydroxide Complexes in
Heavy Metals for Pollution Control,	Distribution of Radioactivity in and Near the	Neutral and Basic Media to Rainbow Trout,
W73-02738 5A	Rainier Rubble Chimney,	W73-02951 5C
	W73-02723 5B	Organization Insertials Hashints and
ADIATION SAFETY STANDARDS	BILLOG Distribution in a Reduced Model Ci-	Organochlorine Insecticide, Herbicide and Polychlorinated Biphenyl (PCB) Inhibition of
Environmental Effects Specific to Nuclear Power Production,	RU106 Distribution in a Reduced Model Simu- lating River Banks; Some Hydrodynamic and	Nakatpase in Rainbow Trout,
W73-02774 5C	Kinetic Aspects of Its Adsorption on Sedi-	W73-03165 5C
30	Runding Aspects of its Ausorption on Sent-	30

Great Lakes Aid, W73-03234

ESSERVOIR REC Flood Control Programming, W73-02667

ESSERVOIR REI Optimal Opera Reservoirs, W73-02707

ESSERVOIR STO Flood Control Programming, W73-02667

Optimal Opera Reservoirs, W73-02707 RESERVOIRS Experimental Transients in R III, W73-02706 Thermal Stratifi in Storage Resei W73-02777

Control of The Valley Reservoir W73-02778

Superdams: The W73-02850

Pre-Impoundme Saylorville Rese W73-02912

Surface Phytop the Physical-Cl Areas on Lake 7 W73-03072

Method for Deto Ooze Deposits sian), W73-03115 Transistorized Off Controller) to Water Reserv W73-03198 W73-03231 Preliminary Ana bility, W73-03233

Desalting and P lon Exchange, W73-02998

Porous Support W73-03009

Wet Oxidation Disk Technique, W73-03186

The Use of Q Triiodide Comp Selected Bacteria W73-03188

RAINFALL

RAINFALL Spatial Variation of Rainfall Spectra in South	Multi-Disciplinary Study of Water Quality Relationships: A Case Study of Yaquina Bay, Oregon,	Nimbus 3 and 4 Observations of Snow Cover and Other Hydrological Features in the Western Himalayas.
Africa, W73-03100 2B	W73-02921 5C	W73-03134 78
Gromet II-Rainfall Augmentation in the Philip-	Effect of Reservoir Drawdown on Optimal	Hydrologic Conditions Viewed by the Nimbus
pine Islands,	Operation,	Meteorological Satellites,
W73-03149 3B	W73-03244 4A	W73-03135
Ulminian USA and month.	RECREATION FACILITIES	Fraushofer Line-Depth Sensing Applied to
RAINFALL-RUNOFF RELATIONSHIPS	A Comparison of Public and Resource Ad-	Water,
Annual Compilation and Analysis of Hydrolog-	ministrator Visual Perceptions of an Outdoor	W73-03140 5A
ic Data for Urban Studies in the Dallas, Texas Metropolitan Area, 1970,	Water-Based Recreation Area,	REPROCESSING
W73-02652 7C	W73-02612 6B	Survey of the Mercury Reprocessing Industry,
	RED SPOT DISEASE	1968-1970,
Some Extensions of Linear Systems Analysis	Distribution of Red Spot Disease in Waters	W73-02931 50
in Hydrology, W73-02662 2A	Used for Fish Breeding (In Russian),	REPRODUCTION
W73-02662 2A	W73-03109 5C	The Biology of a Landlocked Form of the Nor-
Vegetation, Runoff, and Sediment Yield Rela-	REEDY RIVER BASIN	mally Catadromous Salmoniform Fish Galaxia
tionships,	Application of a Digital Hydrologic Simulation	Maculatus (Jenyns): I. Life Cycle and Origin,
W73-03067 5B	Model to an Urbanized Watershed,	W73-02855
Annual Compilation and Analysis of Hydrolog-	W73-02946 2A	Culture, Reproduction, and Temperature
ic Data for Cow Bayou, Brazos River Basin,	REFUELING POLICIES	Tolerance of Pontoporeia affinis in the Labor-
Texas, 1970,	Analysis of the Effects on Oil Spills of Fuel	tory,
W73-03147 7C	Policy Changes and the Addition of Another	W73-03168 50
. 10 70 11 11 17 11	Fuel Pier with the Aid of a Computer Simula-	REPRODUCTION (FISH)
Annual Compilation and Analysis of Hydrolog-	tion Model, W73-02908 5G	Natural Reroduction of Fish in the Volgograf
ic Data for Urban Studies in the San Antonio, Texas Metropolitan Area, 1970,	# 13-02906	Reservoir (In Russian),
W73-03148 7C	REGIONAL ANALYSIS	W73-03102
AND ADDRESS OF THE PARTY OF THE	Columbia River Interstate Compact, Politics of	RESEARCH AND DEVELOPMENT
RAVINES	Negotiation, W73-02614 6E	Annual Report of Activities During Fiscal Year
A Southern Outpost of Steppe Ravine Forest in	W/3-02014 GE	1972.
Semi Desert, (In Russian), W73-02758	The River Basin Model: The Social Science	W73-02630 9A
W/3-02/36	Laboratory.	A Six-Year Review.
RAYON PRODUCTION WASTES	W73-02853 6B	W73-02655 9A
Effluent and Water Quality Control of a Synthetic Fiber Pulp Mill (Abwasser Und	An Approach for Involving Local Officials and Citizens in Regional Water Quality Studies,	Evaluation of Potable Water Storage Tanks, W73-02656 56
Gewaesserschutz Einer Kunstfaserzelistof-	W73-02956 5G	
fabrik), W73-03157 5D	Spatial Variation of Rainfall Spectra in South	The Importance of a Practical Research Input to Water Resources Development,
REAERATION	Africa,	W73-02878 68
Oxygen Transfer to Water and to Sodium	W73-03100 2B	The Transfer of Water Research Output by the
Sulfite Solutions,	REGIONAL DEVELOPMENT	Environmental Protection Agency,
W73-02962 5G	Thurston County, A Comprehensive Water and	W73-02879 6
College of Management Medical of the Name of	Sewerage Plan, Volume II, Water Plan. W73-02865 6D	RESEARCH FACILITIES
RECHARGE	W 73-02803	Water Research at the University of Connec-
A New Technique for Estimating Recharge Using a Digital Model,	REGULATION	ticut.
W73-02801 4B	Pollution Policy.	W73-02631 9A
45	W73-02959 5G	RESEARCH PROJECTS
RECHARGE WELLS	Ecological River Basin Management,	Inventory of Active Water Resources Research
Gravitational and Dispersive Mixing in	W73-03092 6E	Projects in North Carolina.
Aquifers,	PROVIL A PROMO	W73-02629 90
W73-02791 2F	REGULATIONS Pollution Hearing Sets a Southern Landmark.	Water Research at the University of Connec
RECLAIMED WATER	W73-02960 5G	ticut.
Public Attitudes Toward Reuse of Reclaimed		W73-02631 9A
Water,	REMOTE SENSING	THE THE PARTY OF T
W73-02601 5D	Remote Sensing of Sea Ice from Earth Satel- lites,	RESERVOIR CAPACITY
RECREATION	W73-02645 7B	Risk Programming: An Aid in Planning Reservoir-Irrigation Systems,
A Comparison of Public and Resource Ad-	3 - 1172 - 22 - 27 - 27 - 27 - 27 - 27 -	W73-03248
ministrator Visual Perceptions of an Outdoor	A Land-Use Classification System for Use	The state of the s
Water-Based Recreation Area,	With Remote-Sensor Data, W73-02649 7B	RESERVOIR OPERATION Effects of Reservoir Operating Policy of
W73-02612 6B	W73-02649 7B	Recreation Benefits,
Effects of Reservoir Operating Policy on	Remote Sensing of Environmental Pollution,	W73-02618
Recreation Benefits.	W73-03131 . 5A	
W73-02618 6B	Remote Sensing of Water Pollution,	Modeling Discharge and Conservative Walts Quality in the Lower Kansas River Basin,
	W73-03132 SA	W73-02658
RECREATION DEMAND		
Pre-Impoundment Boating Activity in the Saylorville Reservoir Area,	Remote Sensing of Snow Fields from Earth	Optimal Operation of Serially-Linked Water Reservoirs,
W73-02912 6B	Satellites, W73-03133 7B	W73-02707
00	Charles His All and Charles and Carlo and Charles	10 (000000

Great Lakes Simulation ModelA Decision	RESOURCES MANAGEMENT	RIVER BASIN DEVELOPMENT
Aid, W73-03234 2H	New Attitudes About Legal Protection for	Application of a Digital Hydrologic Simulation
W73-03234 2H	Remains of Florida's Natural Environment, W73-03216 6E	Model to an Urbanized Watershed, W73-02946 2A
ESERVOIR REGULATION	W/3-03210	W73-02946 2A
Flood Control Storage Allocations by Linear	RESPIRATION	Ecological River Basin Management,
Programming,	A C-14 Assay for Photorespiration in Aquatic	W73-03092 6E
W73-02667 4A	Plants,	A Mathed of Companies Forest Braduction
ESERVOIR RELEASES	W73-02978 5C	A Method of Comparing Forest Production Data to Agricultural Data in River Basin
Optimal Operation of Serially-Linked Water	Eco-Physiological Studies on Desert Plants, III.	Planning.
Reservoirs,	Respiration of Negatively Photoblastic	W73-03093 6F
W73-02707 4A	Zygophyllum coccineum L. Seeds During Ger-	
ESERVOIR STORAGE	mination,	RIVER BASINS
Flood Control Storage Allocations by Linear	W73-03116 2I	Geology, Soils, and Hydrogeology of Volo Bog
Programming,	The Influence of Herbicide 2,4-D-NA on	and Vicinity, Illinois. W73-02657 2H
W73-02667 4A	Respiration and Survival of Simocephalus vetu-	#13-02037
Cational Committee of Socially Linked Water	lus (O.F. Muller) (Cladocera),	Water Resources of the Minnesota River
Optimal Operation of Serially-Linked Water Reservoirs,	W73-03166 SC	Hawk Creek Watershed, Southwestern Min-
W73-02707 4A		nesota,
and the second of the second o	RESPIRATION (FISH)	W73-02663 7C
RESERVOIRS	Some Data on the Respiration of Salmon Ju- veniles in Relation to the Biotechnique of	Improved River Basin Utilization Through
Experimental Investigation of Hydraulic	Breeding, (In Russian),	Systems Analysis,
Transients in River-Reservoir Systems, Phase	W73-02683 8I	W73-02665 6A
III, W73-02706 8B		D. D. L. W. L. C
AVANCED AND CONTRACT OF MINE OF MINES	REVERSE OSMOSIS	River Basin Modeling, an Approach to Com-
Thermal Stratification and Thermocline Control	Porous Support Tubes for Reverse Osmosis,	puter Simulation of the Bitterroot-Clark Fork River Basin.
in Storage Reservoirs,	W73-03009 3A	W73-02857 4A
W73-02777 5B	REVIEWS	11 10 02007
Control of Thermal Stratification in Thames	A Six-Year Review.	Comprehensive Survey of Elk River Basin,
Valley Reservoirs.	W73-02655 9A	Volume II, Economic Base Study,
W73-02778 5B	The second secon	W73-02860 6D
	Urban SedimentationIn Perspective,	Map Showing Drainage Basins and Historic
Superdams: The Perils of Progress, W73-02850 6G	W73-02793 2J	Cloudburst Floods in the Salina Quadrangle,
W/3-02830	The Importance of a Practical Research Input	Utah,
Pre-Impoundment Boating Activity in the	to Water Resources Development,	W73-03152 7C
Saylorville Reservoir Area,	W73-02878 6B	RIVER REGULATION
W73-02912 6B		
Surface Phytoplankton and Some Aspects of	Literature Review: Economics, W73-02934 5G	The Warwickshire Avon: A Case Study of Water Demands and Water Availability in an
the Physical-Chemical Limnology of Three	W15-02554	Intensively Used River System,
Areas on Lake Texoma,	Residue Reviews, Vol. 33.	W73-03103 6D
W73-03072 2H	W73-03197 5G	
Mathed for Determining Number of Bostonia in	BURDIOON	RIVER RHEIDOL (WALES)
Method for Determining Number of Bacteria in Ooze Deposits of Water Reservoirs (In Rus-	RHEOLOGY Non-Darcian Flow of Water in SoilsLaminar	Late-Stage Meander Growth, W73-02796 23
sian),	Region,	# 13-02190
W73-03115 5A	W73-02836 2G	RIVER SYSTEMS
and the second legal of the property of the	In a continuous services of the continuous servi	The Impact of Water Development on the
Transistorized Level Switching Circuits (On	RHODE ISLAND	Ecology of River Systems,
Off Controller) and their Possible Applications to Water Reservoir: II,	Periphyton and Phytobenthon as Indicators of	W73-03068 5B
W73-03198 4A	Water Quality, W73-02625 5B	RIVERS
Charles Company of the Control of th	W 13-02023	Experimental Investigation of Hydraulic
An Alternative Approach for Finding Optimal	Fall River Harbor, Massachusetts and Rhode	Transients in River-Reservoir Systems, Phase
Control Rules of Reservoir Systems,	Island (Draft Environmental Impact State-	m,
W73-03231 4A	ment).	W73-02706 8B
Preliminary Analysis of Surface Water Availa-	W73-03144 8A	RU106 Distribution in a Reduced Model Simu-
bility,	RICE-M	lating River Banks; Some Hydrodynamic and
W73-03233 4A	Radial Oxygen Losses from Intact Rice Roots	Kinetic Aspects of Its Adsorption on Sedi-
RESINS	as Affected by Distance from the Apex,	ments (Repartition Du RU106 Dans Un Modele
Desalting and Purifying Water by Continuous	Respiration and Waterlogging,	Reduit Simulant Les Berges D'Une Rivi ere),
lon Exchange,	W73-02930 3F	W73-02724 5B
W73-02998 3A	DICE PROCESS WASTE WATER	An Economic Inventory of the Miami River
	RICE PROCESS WASTE WATER Anaerobic Treatment of Starch Wastewaters,	and Its Economic and Environmental Role in
Porous Support Tubes for Reverse Osmosis, W73-03009	W73-02619 5D	Biscavne Bay.
W73-03009 3A		W73-02923 4A
Wet Oxidation of Nylon 6,6 by the Rotating	RISKS	
Disk Technique,	Discount Rates for Public Investment Under	Compilation of Water Quality Data and
W73-03186 5D	Uncertainty,	Parameters from Kansas Rivers and Streams, W73-02973
The Use of Quaternary Ammonium Resin-	W73-02942 6B	W73-02973 5A
Triodide Complex to Inactivate Virus and	Risk Programming: An Aid in Planning Reser-	On the Optimization of the Design of Storage
Selected Bacteria,	voir-Irrigation Systems,	Areas at River Dams,
W73-03188 5F	W73-03248 3F	W73-03239 4A

ROAD CONSTRUCTION

ROAD CONSTRUCTION		
ROAD CONSTRUCTION Slotted Corrugated Metal Pipe Drains, W73-02659 8A	ROUGHNESS (HYDRAULIC) Equivalent Roughness for Shallow Channels, W73-02786 8B	
ROCKALL BANK (ATLANTIC OCEAN) Slumping on the Eastern Margin of the Rockall Bank, North Atlantic Ocean, W73-02799 23	Forces Exerted on Small Structures by a Fluid with a Free Surface in Alternating Movement (efforts exerces par un fluide a surface libre en mouvement alternatif sur des structures fines), W73-03039	
ROCKS Distribution of Radioactivity in and Near the Rainier Rubble Chimney, W73-02723 5B	Approximate Calculation of a Thermally Stratified Turbulent Boundary Layer in a Re- gion Downstream. A Sharp Change in the	
ROMANIA Investigations on the Development of Some Or-	Roughness of the Surface at Which Flow Takes Place, W73-03058	
namental Wood Species on Eroded Saline Soil of the Mouth of Jijia-Bahlui Depression, (In Rumanian),	RUDD The Breeding and Raising of the Pike Perch in	
W73-02680 3C	Ponds, W73-02700 8I	
Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (In Rumanian), W73-02686 2I	RUNOFF Water Balance of the Kara-Batkak Glacier Basin (Vodnyy balans lednikovogo basseyna na primere lednika Kara-Batkak), W73-02635 2C	
ROOT DISTRIBUTION Effect of Lateral Development of Prosopis juliflora DC. Roots on Agricultural Crops,	Tritium in Investigation of Surface Hydrology. Experimental Determination of Coefficient of	
W73-03101 3F Patterns of Water Uptake and Root Distribu-	Runoff, W73-02713 5B	
tion of Soybeans (Glycine max.) in the Presence of a Water Table,	RURAL AREAS Public Water Supply Districts: Evaluation of a New Institution,	
W73-03114 3F	W73-02918 6E	
Contribution to the Knowledge of the Growth of the Maize Root System Under Irrigation	Village Technology Handbook. W73-02922	
Conditions, W73-02668 3F	RURAL SOCIOLOGY Organizational Aspects of Irrigation Systems, W73-03106 3F	
The Use of a Multi-Celled Apparatus for Anaerobic Studies of Flooded Root Systems, W73-03194 21 ROOTS Investigations into the Formation of Biogenetic Vertical Tubes in the Subsoil of Diked Marshes	RUTHENIUM RADIOISOTOPES Uptake of Ru106 by Marine Organisms in Aquaria and in the Natural Environment (Ob- servations Concernant les Contaminations Ex- perimentales et les Contaminations 'In situ'	-
in Schleswig-Holstein, (In German), W73-02687 21	D'especes Marines Par Le Ru106, W73-02717 5B	
The Response of Gooseberries to Non-Tillage Systems of Management, W73-02699 3F Radial Oxygen Losses from Intact Rice Roots	Insoluble Species and Polymerization of Nitrato Complexes of Nitrosylruthenium in Sea Water (Nouvelles Etudes Sur Les Formes Insolubles Et Sur Les Phenomenes De Polymerisation Des Nitratocomplexes Du Nitrosylrut henium En Eau De Mer),	
as Affected by Distance from the Apex, Respiration and Waterlogging, W73-02930 3F	W73-02731 5B	
ROTARY VACUUM PRECOAT FILTRATION Precoat Vacuum Filtration and Natural-Freeze	Water Consumption in the Growth of Organic Substances in Certain Biocoenoses in the Southern Taiga, (In Russian), W73-02688	
Dewatering of Alum Sludge, W73-02965 SF ROTATING DISK GEOMETRY	SAFETY FACTORS Examples of the Internal Condtions of Some	
Wet Oxidation of Nylon 6,6 by the Rotating Disk Technique, W73.03186	Old Earth Dams, W73-02841	
ROTHSCHILD (WISC) Specific Capacities of Wells in Crystalline Rocks,	Environmental Influence on the Pattern of Plant Communities Along the North Rim of the Grand Canyon, W73-03078 21	
W73-02800 4B	SAINT JOHN RIVER SYSTEM Mathematical Models and their Use in Water	
Aerating Apparatus, W73-02984 5D	Resources Decision-Making, W73-03237	

SALINA QUADRANGLE (UTAH) Map Showing Drainage Basins and Historic
Cloudburst Floods in the Salina Quadrangle, Utah.
W73-03152 MOSTA STORES CLOSE 7C
SALINE
Investigations on the Development of Some Or- namental Wood Species on Eroded Saline Soil of the Mouth of Jijia-Bahlui Depression, (In Rumanian),
W73-02680 3C
SALINE SOILS Calcium and Salt Toleration by Bean Plants, W73-03094
W 17 0 W 181 1 W 0
Mineral Ion Composition of Halophytic Species from Northern Utah, W73-03117 21
SALINE WATER
Isopiestic Determination of Solubilities in
Mixed Salt Solutions. Two Salt Systems,
W73-03063 2K
SALMON
Effects of Locomoter Restraint and of
Anaesthesia with Urethane or MS-222 on the Reactions of Young Salmon (Salmo salahrL.) to
Environmental Fluctuations of pH and Carbon
Dioxide Tension, W73-03169 SC
A Sept. Month American Property of The Common S.
Acidity and Lactate Content in the Blood of Young Atlantic Salmon (Salmo salar L.) Ex- posed to High pCO2,
W73-03170 5C
SALMON JUVENILES
Some Data on the Respiration of Salmon Ju-
veniles in Relation to the Biotechnique of Breeding, (In Russian),
W73-02683 81
SALMON RAISING Raising Salmon in the Inland Waters of Japan,
(In Russian), W73-02899 8I
with the property of the property of
SALMONELLA TYPHIMURIUM The Antibacterial Capabilities of
Polyhalogenated Ion Exchange Resins,
W73-03187
SALT CREEK (ILL)
Salt Creek Two Stage Nitrification Plant, W73-02963 5D
SALT MINE DISPOSAL
Radioactive Waste Repository, Lyons, Kansas,
(Final Environmental Impact Statement).
W73-02721 5C
SALT TOLERANCE
Salt Injury to Plants with Special Reference to Cations Versus Anions and Ion Activities, W73-03077 3C
The Englishman
Effects of Salt Treatments of Cotton Plants (Gossypium hirsutum L.) on Leaf Mesophyll Cell Microstructure,
W73-03081 3C
Interaction of Temperature and Salinity on Sugar Beet Germination, W73-03084 3C
Salt Tolerance of Safflower Varieties (Carthamus tinctorius L.) During Germination, W73-03088 3C

SALINA QUADRANGLE (UTAH)

Calcium and W73-03094

Seed Pellet Nitrogen Fi Saline Alka W73-03097

Growth Reg W73-03104 Mineral Ion from North W73-03117

SAMPLING Application Heavy Met W73-02738 Annual Re

Radiation I W73-02744 Phosphorus from Chron

W73-02968

Environme Discharges from UKA W73-03220

SAN ANTON Chemical a at Selected as, August W73-02808 Annual Co

ic Data for Texas Met W73-03148 SAN FRANC An Approx Citizens in W73-02956

SAN FRANC Programm Manageme W73-03240 SANITARY

Shipboard W73-02907 SANTA BAR Water Red 1967 to 19

W73-02868 SASKATCH Multireser

Quantity S W73-0266 SATELLITE Remote S

lites. W73-0264 A Land-I With Rem W73-0264

Remote S W73-0313

Calcium and Salt Toleration by Bean Plants, W73-03094 3C	Nimbus 3 and 4 Observations of Snow Cover and Other Hydrological Features in the	Vegetation, Runoff, and Sediment Yield Relationships,
Seed Pelleting in Relation to Nodulation and	Western Himalayas,	W73-03067 5B
Nitrogen Fixation by Phaseolus aureus L. in a	W73-03134 7B	SEDIMENT YIELD
Saline Alkali Soil, W73-03097	Hydrologic Conditions Viewed by the Nimbus Meteorological Satellites,	Urban SedimentationIn Perspective, W73-02793 2J
Response of Osmotically Stressed Plants to	W73-03135 7B	Sediment Yield Computed With Universal
Growth Regulations,	SATSUMA ORANGE TREES	Equation,
W73-03104 3C	Effects of Summer Application of Water and	W73-02794 2J
parse Sundation of the Dates onl-Click, Feet	Nitrogen on Fruit Quality and Flowering of	Desdiction and most wield in Western Heitad
Mineral Ion Composition of Halophytic Species	Satsuma Orange Trees (In Japanese),	Predicting sediment yield in Western United States.
from Northern Utah, W73-03117 2I	W73-02697 3F	W73-02795
and head to lake Manufacture at the A	SCALING	
SAMPLING	Cleaning Water Mains With Foam PlugsEx-	Vegetation, Runoff, and Sediment Yield Rela-
Application of CF252 to the Detection of Heavy Metals for Pollution Control,	perience at Washington, D. C., W73-02862 5G	tionships, W73-03067 5B
W73-02738 5A	ALL TO SEE SEE SEE SEE SEE SEE SEE SEE SEE SE	OPPORTUNIT A PROMI
White was a law of the waste of	SCALLOPS	SEDIMENTATION Control of Mercury Pollution in Sediments.
Annual Report of the Eastern Environmental	Growth of the Bay Scallop: The Influence of	W73-02632 5G
Radiation Laboratory, January-December 1970. W73-02744 5B	Experimental Water Currents, W73-02702 2L	
mination which who extra the contract	W13-02/02	Insoluble Species and Polymerization of
A System for the Rapid Analysis of Organic	SCHLESWIG-HOLSTEIN	Nitrato Complexes of Nitrosylruthenium in Sea
Phosphorus in Water Samples or Fractions	Investigations into the Formation of Biogenetic	Water (Nouvelles Etudes Sur Les Formes In- solubles Et Sur Les Phenomenes De
from Chromoatographic Columns, W73-02968 5A	Vertical Tubes in the Subsoil of Diked Marshes	Polymerisation Des Nitratocomplexes Du
W73-02968 5A	in Schleswig-Holstein, (In German), W73-02687	Nitrosylrut henium En Eau De Mer),
Environmental Monitoring Associated with	W/3-0268/	W73-02731 5B
Discharges of Radioactive Waste During 1969	SEA ICE	Columbia Diver Effects in the Northeast
from UKAEA Establishments.	Remote Sensing of Sea Ice from Earth Satel-	Columbia River Effects in the Northeast Pacific: Chemical and Geological Studies.
W73-03220 5B	lites,	Progress Report, Sept. 1971 to May 1972.
SAN ANTONIO (TEX)	W73-02645 7B	W73-02751 5B
Chemical and Bacteriological Quality of Water	SEA WATER	THE PROPERTY OF THE PARTY OF TH
at Selected Sites in the San Antonio Area, Tex-	Desalting as a Source of Water Supply,	SEDIMENTOLOGY The Use of Electrical Resistivity to Determine
as, August 1968-April 1972,	W73-02861 3A	Porosity of Marine Sediments,
W73-02808 5B	Bataslaum Hudanashana and the Con	W73-03141 2J
Annual Compilation and Analysis of Hydrolog-	Petroleum Hydrocarbons and the Sea, W73-02866 5C	ON PERSONAL PROPERTY.
ic Data for Urban Studies in the San Antonio,	W 15-02000	SEDIMENTS
Texas Metropolitan Area, 1970,	SECONDARY MORTALITY	Control of Mercury Pollution in Sediments. W73-02632 5G
W73-03148 7C	A Simple Technique for Detecting Effects of	117-02002
SAN FRANCISCO BAY	Toxicants or Other Stresses on a Predator-Prey Interaction,	Synoptic Measurements of Currents and Sedi-
An Approach for Involving Local Officials and	W73-03161 5C	ment Transport on the Continental Shelf. An-
Citizens in Regional Water Quality Studies,		nual Progress Report, W73-02716 2L
W73-02956 5G	SECONDARY PRODUCTIVITY	
SAN FRANCISCO BAY SYSTEM	Columbia River Effects in the Northeast	Environmental Sampling for River Sediments
Programming Model of Regional Water Quality	Pacific: Biological Studies. Progress Report, July 1971-June 1972.	Around a Nuclear Power Station,
Management,	W73-02750 5B	W73-02740 5B
W73-03240 5G		Origin of Manganese Nodules of the Pacific
SANITARY SEWAGE	SEDIMENT CONTROL	Ocean From Radioisotope Data,
Shipboard Control of Wastes,	Urban SedimentationIn Perspective,	W73-02752 5B
W73-02902 5G	W73-02793 2J	SEED TREATMENT
NOW THE REAL PROPERTY.	SEDIMENT DISCHARGE	Seed Pelleting in Relation to Nodulation and
SANTA BARBARA COUNTY	Columbia River Effects in the Northeast	Nitrogen Fixation by Phaseolus aureus L. in a
Water Requirements of Santa Barbara County, 1967 to 1990,	Pacific: Biological Studies. Progress Report,	Saline Alkali Soil, W73-03097 3C
W73-02868 6D	July 1971-June 1972. W73-02750 5B	W 73-03097
1173-02000	W 13-02130	Eco-Physiological Studies on Desert Plants. III.
SASKATCHEWAN-NELSON BASIN	SEDIMENT TRANSPORT	Respiration of Negatively Photoblastic
Multireservoir Analysis Techniques in Water	Dispersion of Contaminated Bed-Load Parti-	Zygophyllum coccineum L. Seeds During Ger- mination,
Quantity Studies, W73-02664 4A	cles, W73-02650 5B	W73-03116 2I
SATELLITES (ARTIFICIAL)	Temperature Effects in High-Transport, Flat-	SEEDS
Remote Sensing of Sea Ice from Earth Satel-	Bed Flows,	Seed Pelleting in Relation to Nodulation and Nitrogen Fixation by Phaseolus aureus L. in a
lites, W73-02645 7B	W73-02789 2J	Saline Alkali Soil,
W73-02645 7B	Bed-Load Transport in Mountain Streams,	W73-03097 3C
A Land-Use Classification System for Use	W73-02893 2J	
With Remote-Sensor Data,	Methods for the Characterization of Suspended	Eco-Physiological Studies on Desert Plants. III. Respiration of Negatively Photoblastic
W73-02649 7B	Sediment and Selected Applications for the	Zygophyllum coccineum L. Seeds During Ger-
Remote Sensing of Environmental Pollution,	Acquired Data,	mination.
W73-03131 5A	W73-02977 5B	W73-03116 21

SEISMIC PROPERTIES

· ·		
SEISMIC PROPERTIES The Relationship Between the Physical Proper-	Surcharges and Stream Charges as Economic Incentives,	SIMULATION ANALYSIS
ties of Underwater Sediments That Affect Bot-	W73-03190 5G	Application of Biological Monitoring Systems to Simulated Industrial Waste Discharge Situa-
tom Reflection,	W71,63134	tions, wheat of contain a garages had
W73-02798 2J	SEXUAL MATURITY Low Level Chronic Irradiation of Salmon. An-	W73-02617
SEISMIC STUDIES	nual Progress Report,	Multireservoir Analysis Techniques in Water
The Relationship Between the Physical Proper- ties of Underwater Sediments That Affect Bot-	W73-02714 5C	Quantity Studies,
tom Reflection,	SHEAR FAILURE	W73-02664
W73-02798 2J	Internal Piping and Shear Deformation Victor	River Basin Modeling, an Approach to Com-
SELECTIVITY	Braunig Dam - San Antonio, Texas,	puter Simulation of the Bitterroot-Clark Fork River Basin.
Evidence for Hormonal Regulation of the	W73-03250 8D	W73-02857 4A
Selectivity of Ion Uptake by Plant Cells, W73-03113	SHEAR STRESS	Le College of A Sec. To service by A site 200 years
W/3-03113	The Magnitude of Shear Stresses Acting on the	A Computer Simulation Model for Flood Plain Development, Part 1: Land Use Planning and
SEMIPERMEABLE MEMBRANES	Bottom of Open Channels by Propagating	Benefit Evaluation,
Porous Support Tubes for Reverse Osmosis, W73-03009 3A	Surge Waves, W73-03038	W73-02944 4A
WYS STORES WITH THE THE SHIPE STORE	The state of the s	Application of a Digital Hydrologic Simulation
SEPARATION TECHNIQUES Methyl Mercury Acetate From Waters by	SHEET EROSION	Model to an Urbanized Watershed,
Chromatography on Chelating Polymers,	Predicting sediment yield in Western United States,	W73-02946 2A
W73-03179 5A	W73-02795 2J	Patterns of Drainage Areas With Random
SETTLING BASINS	SHIPS	Topology,
Mechanisms of Sludge Thickening,	Shipboard Control of Wastes,	W73-03075
W73-02948 5D	W73-02902 5G	A Self-Verifying Hybrid Computer Model of
SETTLING VELOCITY	Supplementally and the supplemental and the supplem	River-Basin Hydrology,
Forces Due to Cylinders Falling Through Water	Cost Analysis of Optional Methods of Ship- board Waste Disposal,	W73-03183 2A
in a Vertical Tube, W73-03021	W73-02916 5E	The Miami Conservancy District Experience in
W/3-03021	- 103 (0.12 y y y y y y y y y y y y y y y y y y y	the Systems Approach to Water Quality Im-
SEWAGE	Hydrodynamic Pressure of Nonstationary Flow in Canals Acting on Moored Ships,	provement,
Water Resources Management in Delaware, W73-02622 6B	W73-03033 8B	W73-03225 5G
PER SECTION OF THE PERSON OF T	to the other season and the same of the season and	Great Lakes Simulation Model-A Decision
The Interaction of Sewage, Thermal, and Acid	Forces Exerted on Small Structures by a Fluid with a Free Surface in Alternating Movement	Aid, W73-03234 2H
Mine Water Loadings on the Growth of Chlorella,	(efforts exerces par un fluide a surface libre en	W73-03234 2H
W73-02974 5C	mouvement alternatif sur des structures fines),	Application of Hydrologic Simulation to Water
SEWAGE TREATMENT	W73-03039 8B	Resources Planning, W73-03236
Mass Transfer and Chemical Reaction in Two-	SHRIMP	the state of the party of the control of the same than
Phase Flow,	Commercial Shrimp FarmingNearing Reali-	SINKS
W73-02875 5D	ty,	Role of Vertical Shafts in the Movement of Ground Water in Carbonate Aquifers,
FWQA Sets Rules for Sewage Treatment Plant	W73-02932 3E	W73-02803 2F
Design. W73-02958 5D	SHRIMP FARMING	SITES ACCEPTAN
A THE RESIDENCE OF THE PROPERTY OF THE PROPERT	Commercial Shrimp FarmingNearing Reali-	Location of Wells and Test Holes, Hartford
Sewage Treatment System, W73-02983 5D	ty, W73-02932 3E	North Quadrangle, Connecticut,
W73-02983 5D	W73-02932 3E	W73-03153 7C
Aerating Apparatus,	SIEROZEM	Sites of Solid-Waste Storage and Liquid-Waste
W73-02984 5D	External Friction Coefficient of Sierozem (In Russian).	Discharge, Hartford North Quadrangle, Con-
Sewage Treatment Apparatus,	W73-03213 2G	necticut, W73-03154 7C
W73-02987 5D		W 75-03154
Removal of Phosphates from Sewage Effluent,	SILICON Underground Mineral Water of Alpine Regions	SLASH PINE
W73-03000 5D	of Southeastern Kazakhstan (Podzemnyye	Early Growth and Development of Slash Pine Under Drought and Flooding,
Biochemical Sewage Treatment Via High Puri-	mineral'nyye vody vysokogornykh rayonov	W73-03207 4A
ty Molecular Oxygen,	Yugo-Vostochnogo Kazakhstana), W73-02818 4B	
W73-03004 5D	W73-02818 4B	SLIDE GATES Hydrodynamic Forces on Single Intake Gates,
Apparatus for Biologically Purifying Sewage,	SILVER IODIDE	W73-03046 8B
W73-03014 5D	Performance of an Atmospheric Water	A COMPANY OF THE PARTY OF THE P
SEWER RATES	Resources Research Program in the Hungry Horse Area, Montana.	SLOPES Occurrence of Groundwater in the Piedmont
Surcharges and Stream Charges as Economic Incentives.	W73-03143 3B	Alluvial Plain on the Northern Slope of Dzun-
W73-03190 5G		garian Ala Tau (Formirovaniye podzemnykh
Saline Askop Soul	Gromet IIRainfall Augmentation in the Philip- pine Islands.	vod predgornogo shleyfa severnogo sklona Dz-
SEWERAGE Thurston County, A Comprehensive Water and	W73-03149 3B	hungarskogo Alatau), W73-02816 4B
Sewerage Plan, Volume II, Water Plan.	Tana and the second sec	and the second s
W73-02865 6D	SIMPSON COUNTY (MISS) Water for Industrial Development in Copiah	SLUDGE Determination of Total Mercury in Sludge (In
Shipboard Control of Wastes,	and Simpson Counties, Mississippi,	Japanese),
W73-02902 5G	W73-02651 3E	W73-02945 5A

SLUDGE DIS Optimal C Activated W73-02616 Mechanist W73-02948

5A

SLUDGE PR Water-Tre Now, W73-0296 SLUDGE TH Mechanis W73-0294

SLUDGE TI Optimal Activated W73-0261 Water-Tr Now, W73-0296

Precoat V Dewateri W73-029 SMALL AN Bioassay Major In W73-028

SMALL W An App Hydrolo W73-028 Annual (ic Data

W73-031 SNOW CO Nimbus and O Western W73-03 SNOW M

Impact And-Ice W73-02 SNOW SU Remote Satellite

W73-03 SOAKING Eco-Ph Respire Zygoph minatio W73-03

SOCIAL Discou Uncert W73-0

SOCIAL A Co minist Water-W73-0

SLUDGE DISPOSAL	SOCIO-ECONOMIC ASPECTS	Sediment Yield Computed With Universal
Optimal Conditioning Procedures for Waste Activated Sludge Disposal,	Systems Analysis and Water Quality Manage- ment,	Equation, W73-02794
W73-02616 5D	W73-02943	SOIL MECHANICS
Mechanisms of Sludge Thickening,	SODIUM	A Hydrophilic Polymer as a Soil Amendment,
51/72 02040 FD	Sodium Export From Bean Leaves as Affected	W73-03098 2G
W/3-02948	by the Mode of Application,	1 2 10 10 10 1 10 11 11 11
SLUDGE PRODUCTION	W73-03073	A Rapid Grain Size Analysis Method, W73-03249 8D
Water-Treatment-Plant Waste DisposalAction Now.	The Influence of Low Substrate Sodium Levels	TOTAL MODERNIA
W73-02964 5F	Upon the Free Amino Acid Content of Cotton	SOIL MOISTURE Cherry Yields as Conditioned by Soil Moisture
SLUDGE THICKENING	Leaves, W73-03089 3C	(In Russian),
Mechanisms of Sludge Thickening,	W75-05005	W73-02679 3F
W73-02948 SD	SODIUM ALUMINATE	Effects of Summer Application of Water and
AND SAME SAME SAME SAME SAME SAME SAME SAME	Removal of Phosphates from Sewage Effluent,	Nitrogen on Fruit Quality and Flowering of
SLUDGE TREATMENT	W73-03000 5D	Satsuma Orange Trees (In Japanese), W73-02697
Optimal Conditioning Procedures for Waste	SODIUM CHLORIDE	W /3-0269/
Activated Sludge Disposal, W73-02616 5D	Pollution by Coliform Bacteria in Sea Water of	Available Water Capacities of Zambian Soils in
35	Swimming Resorts: II (In Japanese),	Relation to Pressure Plate Measurements and
Water-Treatment-Plant Waste DisposalAction	W73-02928 5B	Particle Size Analysis, W73-03065 2G
Now,	SODIUM SULFITE	W 75-03063
W73-02964 5F	Oxygen Transfer to Water and to Sodium	External Friction Coefficient of Sierozem (In
Precoat Vacuum Filtration and Natural-Freeze	Sulfite Solutions,	Russian), W73-03213 2G
Dewatering of Alum Sludge,	W73-02962 5G	W 75-03213
W73-02965 5F	SOIL AMENDMENTS	SOIL PHYSICAL PROPERTIES
SMALL ANIMALS (MAMMALS)	A Hydrophilic Polymer as a Soil Amendment,	A Method for the Determination of the Ther-
Bioassays of Quality in Water Resources of	W73-03098 2G	mal Properties of Soil Near the Surface, W73-03076 2G
Major Importance to New Mexico,	The Selection by Province Inc. Physical Printers	W 73-03076
W73-02876 5C	SOIL ASSOCIATIONS	Influence of Shape of Implements on Soil
Application Comment Service Comments	Soil Associations and Land Classification for Irrigation, Lincoln County,	Structure, W73-03203 2G
SMALL WATERSHEDS	W73-02623 3F	W73-03203 2G
An Application of Multi-variate Analysis in Hydrology,	ACREA FUELA	Hydrophysical Characteristics of Typical
W73-02873 2E	SOIL BACTERIA	Sierozem in the Yavan Valley (In Russian),
Settleton and the settle settl	Virus-Sized Particle Adsorption on Soil-Part I: Rate of Adsorption,	W73-03212 2G
Annual Compilation and Analysis of Hydrolog-	W73-03177 5B	Comparative Characteristics of Old-Irrigated
ic Data for Cow Bayou, Brazos River Basin, Texas, 1970,	AND TOUR CAROLING	Sierozems in the Vakhsh Valley with Com-
W73-03147 7C	SOIL CHEMICAL PROPERTIES	pacted and Uncompacted Subarable Horizons (In Russian).
	Salt Injury to Plants with Special Reference to Cations Versus Anions and Ion Activities,	W73-03215 3F
SNOW COVER	W73-03077 3C	was as a said, see (17), see (4). In see
Nimbus 3 and 4 Observations of Snow Cover	The Assertation towards has an objected as	SOIL PROPERTIES Geology, Soils, and Hydrogeology of Volo Bog
and Other Hydrological Features in the Western Himalayas,	Dynamics of Nutrients in Relation to the	and Vicinity, Illinois.
W73-03134 7B	Hydrological Regime of Soils in Bog Forests of	W73-02657 2H
The state of the s	the Southern Taiga in the Transurals (In Russian),	Soils of Piedmont Debris Cones and the Possi-
SNOW MANAGEMENT	W73-03208 2G	bilities for their Agricultural Utilization (In
Impact of Snowpack Management on Snow- And-Ice Hydrology,		Russian),
W73-02851 3B	The Contents of Trace Elements in Eroded Sod Podzolic Soils Formed on Morainic Deposits in	W73-03209 2G
	the Poozer'e (Lake Area) of Belorussia (In	Soils of Northern Turkmenistan and Some of
SNOW SURVEYS	Russian),	their Agricultural Features (In Russian),
Remote Sensing of Snow Fields from Earth	W73-03214 2G	W73-03210 2G
Satellites, W73-03133 7B	SOIL CLASSIFICATION	Condensation Processes in Non-Irrigated Soils
	Soil Associations and Land Classification for	(In Russian),
SOAKING	Irrigation, Lincoln County,	W73-03211 2G
Eco-Physiological Studies on Desert Plants. III.	W73-02623 3F	SOIL TEMPERATURE
Respiration of Negatively Photoblastic Zygophyllum coccineum L. Seeds During Ger-	SOIL CONTAMINATION	A Method for the Determination of the Ther-
mination,	Annual Report of the Eastern Environmental	mai Properties of Soil Near the Surface,
W73-03116 2I	Radiation Laboratory, January-December 1970.	W73-03076 2G
COCIAL DISCOUNT BATE	W73-02744 5B	SOIL TESTS
SOCIAL DISCOUNT RATE Discount Rates for Public Investment Under	SOIL CONTAMINATION EFFECTS	A Method for the Determination of the Ther-
Uncertainty,	Effects of Detergent Polluted Water on Soil	mal Properties of Soil Near the Surface,
W73-02942 6B	Reaction and Plant Growth,	W73-03076 2G
	W73-02620 5C	A Rapid Grain Size Analysis Method,
SOCIAL VALUES	SOIL EROSION	W73-03249 8D
A Comparison of Public and Resource Ad- ministrator Visual Perceptions of an Outdoor	The Response of Gooseberries to Non-Tillage	SOIL TREATMENT
Water-Based Recreation Area,	Systems of Management.	A Hydrophilic Polymer as a Soil Amendment,
W73-02612 6B	W73-02699 3F	W73-03098 2G

STAGE-DI Brink I Weir, W73-027

Aeration W73-031

The Gen W73-025

> Economicry Pollstive Sun W73-025

Pollutio W73-029 STANFOI Applica Model t W73-02

Problem Unstead Method W73-02

On St Cracke W73-02

STATIST
Probler
Unstea
Method
W73-02
Pattern
Topolo
W73-03
STILLIN
Traject
Deviat
flottan
device
W73-03

Optimi Hydra W73-0 STOCH/ Disper cles, W73-0

> Some in Hyd W73-0

Optim Reser W73-0

The T cient i W73-0 Some Mathe Resou W73-0

Stoch W73-4

SOIL WATER

OIL WATER	SOLUBILITY	SOYBEANS
Effect of an Asphalt Barrier on Water Redis-	Environmental Dynamics of Mercury,	Relationship of Plant Moisture Status to Irriga-
tribution after Infiltration in Sandy Soils,	W73-02729 5B	tion Need in Corn and Soybean Crops,
W73-03189 2G	Solubilization of inorganic phosphate by bac-	W73-02604 21
OIL-WATER INDEX	teria isolated from upper Klamath Lake sedi-	Patterns of Water Uptake and Root Distribu-
The Effects of Water Availability on Tea	ment	tion of Soybeans (Glycine max.) in the
Yields in Uganda,	W73.02954 5C	Presence of a Water Table,
W73-02696 3F	by the Mode of Application	W73-03114
	SOLVENT EXTRACTIONS	AON FROM THE PROPERTY OF THE P
DIL WATER MOVEMENT	Feasibility Study of the Application of Solvent	SPAWNING
Thermodynamic Analogy of Mass Transport	Extraction and Gas-Liquid Partition Chro-	Successful Spawning of Largemouth Bass,
Processes in Porous Media,	matography to Marine Trace Metal Analysis,	Micorpterus salmoides (Lacepede) Under
W73-02819 2F	W73-02747 5A	Laboratory Conditions,
A Numerical Study of the Nonlinear Laminar	DOWNER OF THE STATE OF THE STAT	W73-02953 5G
Regime of Flow in an Idealised Porous Medi-	SONAR	SPECIATION
um,	Hydrodynamic Forces Acting on Sonic Oscilla-	Some Species of Phyllodocidae, Syllidae,
W73-02825 2F	tors in Sonic Transmissions (Forces	Nephtyidae, Goniadidae, Apistobranchidae and
58 SERVICE AT 11	hydrodynamiques agissant sur les oscillateurs	Spionidae (Polychaeta) from the Northeast
Problems Concerning Solution of Steady and	soniques prevus dans les transmissions soniques),	Pacific Ocean,
Unsteady Groundwater Flow by Statistical	W73-03056 8B	W73-03221 5B
Methods,	W 75-03030	
W73-02826 2G	SONORA (MEXICO)	SPECIES DIVERSITY
	Morphological and Anatomical Aspects of	Relations Between Biomass and Species Diver-
On the Flow of Two Immiscible Fluids in Frac-	Oedema in Eggplants (Solanum melongena L.),	sity in Marine and Freshwater Zooplankton
tured Porous Media, W73-02828 2F	W73-03105 2I	Communities,
W73-02828 2F	WELLES Salarana Control of the Contr	W73-02967 5C
The Flow of Air and Water in Partly Saturated	SORPTION	SPECTROPHOTOMETRY
Clay Soil,	Sorption in Flow Through Porous Media,	Determination of A Trace Amount of Cadmium
W73-02834 2G	W73-02839 2G	in Water by Atomic Absorption Spec-
Control of the State of the Sta	table and the same of the statement of the	trophotometry Combined with Ammonium Pyr-
An Investigation into the Flow Behaviour	SOUNDING	rolidine Dithiocarbamate-Methl Isobutyl
Through Compacted Saturated Fine-Grained	The Relationship Between the Physical Proper-	Ketone Extraction Using Large Aqueous
Soils with Regard to Fines Content and Over a	ties of Underwater Sediments That Affect Bot-	Phase/Solvent Rati os.
Range of Applied Hydraulic Gradients,	tom Reflection, W73-02798	W73-02939 5A
W73-02835 2G	W73-02798 2J	THE PROPERTY OF THE PROPERTY O
Non-Possine Flow of Water in Calls I amino	SOUTH AFRICA	Production of Geosmin and 2-Exo-Hydroxy-2-
Non-Darcian Flow of Water in SoilsLaminar Region,	Spatial Variation of Rainfall Spectra in South	Methylbornane by Streptomyces odorifer,
W73-02836 2G	Africa,	W73-02949 5A
W 75-02836 20	W73-03100 2B	SPILLWAY FAILURE
Hydrostatics and Hydrodynamics in Swelling		Damage to Karnafuli Dam Spillway,
Media,	SOUTH CAROLINA	W73-02787 8B
W73-02837 2G	Application of a Digital Hydrologic Simulation	W 73-02707
STEEDING STREET, STREET, ST.	Model to an Urbanized Watershed,	SPILLWAYS
Patterns of Water Uptake and Root Distribu-	W73-02946 2A	Damage to Karnafuli Dam Spillway,
tion of Soybeans (Glycine max.) in the	Distribution and Seasonal Occurrence of	W73-02787 8B
Presence of a Water Table,	Tabanidae along a Transect of South Carolina,	
W73-03114 3F	******	Trajectory of Floating Bodies in a Strongly
Effect of an Asphalt Barrier on Water Redis-	W73-03136	Deviating Fluid Vein, (Trajectoire de corps
tribution after Infiltration in Sandy Soils,	Some Ecological Notes on Lotic Dipteran	flottants dans une veine fluide fortement device).
W73-03189 2G	Emergence in Prater's Creek, South Carolina,	W73-03035 8B
di memberahan mananga tandi miy sembi,	W73-03162 5C	W 73-03033
OIL-WATER-PLANT RELATIONSHIPS	The Countries of Proce Statements of Branch Law.	The Impact of the Jet on the Obstacle,
An Economic Analysis of Water-Use Regula-	SOUTHWEST U.S.	W73-03037 8B
tion in the Central Ogallala Formation,	Future Environments of Arid Regions of the	WISHUS .
W73-02892 4B	Southwest.	SPOIL BANKS
Use of Digital Computers for the Heat and	W73-03118 6B	Milwaukee Diked Disposal Area, Wisconsin,
Mass Transfer Analyses of Controlled Environ-	Future Environments of Arid Lands of	(Draft Environmental Impact Statement).
ment Greenhouses,	Southwestern States,	W73-03151 5G
W73-03082 2D	W73-03119 6B	ST. LAWRENCE RIVER
11110	Impulse, Lincoln County, consumer	Jet Boat - Tellurometer Technique for Measur-
Calcium and Salt Toleration by Bean Plants,	A Land-Use Plan for the Arid Southwest,	ing Streamflow in Large Rivers,
W73-03094 3C	W73-03120 6B	W73-02646 7R
Personal Production of the Contract of the Con	Partyreness of BUTA/IRA/ISE 400	TAND THE SECOND TO SELECT THE TANDED TO SELECT THE
Effect of Lateral Development of Prosopis ju-	The Future Human Occupance of the Arid	Progress Report, Biology and Health Physics
liflora DC. Roots on Agricultural Crops,	Southwest,	Division, Environmental Research Branch,
W73-03101 3F	W73-03121 6B	January 1972 to March 31, 1972,
OULS TO THE THE THE PARTY OF THE	Public Land Management in the Arid	W73-02725 5C
Soil Complexes in the East of the Brest	Southwest,	STABILITY
Polesie, (In Russian),	W73-03122 6B	The Decay and Stability of Internal Wave
W73-03006 2G	W/3-03122	Modes in a Multisheeted Thermocline.
The second secon	Arid Lands and Their Future,	W73-02759 SG
OLID WASTE	W73-03123 6B	A de Company of the Control of the Control of the
Radioactive Waste Repository, Lyons, Kansas,		Rotational Stability in Dilute Polymer Solu-
(Final Environmental Impact Statement).	Health Related Problems in Arid Lands.	tions,
W73-02721 5C	W73-03126 5F	W73-02874 2E

STAGE-DISCHARGE RELATIONS	STOMATA	STREAMS
Brink Depth for Trapezoidal Broad-Crested	The Influence of Mist Irrigation on the Potato	The Determination of Primary Production in a
Weir,	1. Micro-Environment and Leaf Water Rela-	Stream Using an Exact Solution to the Oxygen
W73-02788	tions, W73-02888 3F	Balance Equation, W73-02971 5C
Aeration of Weirs,		Complete of Wise Continue Day and
W73-03142 8B	Effects of Water Stress on the Resistance to	Compilation of Water Quality Data and Parameters from Kansas Rivers and Streams,
STANDARDS	Uptake of Carbon Dioxide in Tobacco,	W73-02973 SA
The General Economy.	W73-03193 3F	W 13-02913
W73-02929 SG	STORAGE	On the Equilibrium of a Cable Connected to a Free-Floating Body Placed in a Stream,
	On the Optimization of the Design of Storage	W73-03062 8B
Economic Impact of Anticipated Paper Indus-	Areas at River Dams,	W 73-03002
try PollutionAbatement Costs, Part I: Executive Summary.	W73-03239 4A	STREPTOMYCIN
W73-02941 5G	STORAGE TANKS	Effects of Streptomycin on the Ultrastructure
William Control of the Control of th		of Plastids in Euglena,
Pollution Policy.	Evaluation of Potable Water Storage Tanks, W73-02656	W73-02972 5C
W73-02959 5G	W73-02656 5G	STRONTIUM
	STORM RUNOFF	Radioactivity of Waters in Northeastern Part of
STANFORD WATERSHED MODEL	Annual Compilation and Analysis of Hydrolog-	Atlantic Ocean.
Application of a Digital Hydrologic Simulation	ic Data for Urban Studies in the Dallas, Texas	W73-02710 5B
Model to an Urbanized Watershed,	Metropolitan Area, 1970,	The second secon
W73-02946 2A	W73-02652 7C	STRONTIUM RADIOISOTOPES
STATISTICAL METHODS		Results of Environmental Radioactivity Mea-
Problems Concerning Solution of Steady and	Annual Compilation and Analysis of Hydrolog-	surements in the Community Countries in 1970:
Unsteady Groundwater Flow by Statistical	ic Data for Urban Studies in the San Antonio,	Air-Fallout-Water (Messwerte der Umwel-
Methods,	Texas Metropolitan Area, 1970,	tradioaktivitat in den Landern der
W73-02826 2G	W73-03148 7C	Gemeinschaft im Jahre 1970: Luft Niederschlage-Wasser).
DE STATE OF THE PARTY OF THE PA	STORMS	W73-02726 5B
On Stabilization of Fingers in a Slightly	Flood Hydrographs for Ungaged Streams,	W 13-02120
Cracked Heterogeneous Porous Medium,	W73-02880 2E	STRUCTURAL ANALYSIS
W73-02830 2G	17702000	Comparison of Analytical and Structural
ON A PROPERTY IN ORDER O	STRATIFICATION	Behavior Results for Morrow Point Dam,
STATISTICAL MODELS Problems Concerning Solution of Steady and	Wave-Induced Boundary Layers in a Stratified	W73-02847 8A
Unsteady Groundwater Flow by Statistical	Fluid,	General Purpose Program of Plane Stress Anal-
Methods,	W73-02761 8B	ysis by Finite Element Method, and its Appli-
W73-02826 2G		cation.
A The second state of the second seco	STRATIFIED FLUID	W73-02852 8A
Patterns of Drainage Areas With Random	Wave-Induced Boundary Layers in a Stratified Fluid.	OMBALOMAID AT BURNALINGS
Topology,	W73-02761 8B	STRUCTURAL BEHAVIOR Comparison of Analytical and Structural
W73-03075 4A	# 13-02/01 6B	Behavior Results for Morrow Point Dam,
STILLING BASINS	STREAM EROSION	W73-02847 8A
Trajectory of Floating Bodies in a Strongly	A Survey of Some Possible Effects of Logging	1173-02047
Deviating Fluid Vein, (Trajectoire de corps	on Two Eastern Vancouver Island Streams,	STRUCTURE
flottants dans une veine fluide fortement	W73-03160 4C	Effects of Streptomycin on the Ultrastructure
device),	AMBRITANI AW	of Plastids in Euglena,
W73-03035 8B	STREAMFLOW Date for Colonia 1021, Port	W73-02972 5C
	Water Resources Data for Colorado, 1971: Part	STRUCTURES
Optimized Geometry for Baffle Blocks in	1. Surface-Water Records. W73-02643 7C	Use of Digital Computers for the Heat and
Hydraulic Jumps,	W73-02643 7C	Mass Transfer Analyses of Controlled Environ-
W73-03036 8B	Jet Boat - Tellurometer Technique for Measur-	ment Greenhouses,
STOCHASTIC PROCESSES	ing Streamflow in Large Rivers,	W73-03082 2D
Dispersion of Contaminated Bed-Load Parti-	W73-02646 7B	STURGEON
cles,		Feeding Rhythm of Sturgeon in the Volgograd
W73-02650 5B	Optimal Operation of Serially-Linked Water	Reservoir, (In Russian).
	Reservoirs,	W73-02685 8I
Some Extensions of Linear Systems Analysis	W73-02707 4A	
in Hydrology,	Water Resources Data for Georgia-1971.	STURGEON JUVENILES
W73-02662 2A	W73-02784 7C	Determination of Optimal Proportions of
Optimal Operation of Serially-Linked Water	Medical for the Chercon Admin of Street,	Nitrogen and Phosphorus Contents Used for Pond Fertilization, (In Russian),
Reservoirs.	Annual Compilation and Analysis of Hydrolog-	W73-02681 8I
W73-02707 4A	ic Data for Cow Bayou, Brazos River Basin,	
	Texas, 1970,	SUB-ARCTIC
The Tensor Character of the Dispersion Coeffi-	W73-03147 7C	Trace-Metal Associations in Sub-Artic and Arc-
cient in Anisotropic Porous Media,	STREAMFLOW FORECASTING	tic Marine Environments - Progress Report,
W73-02831 2G	Some Extensions of Linear Systems Analysis	June 1971-May 1972, W73-02754 5B
Some Characteristics and Applications of	in Hydrology,	W73-02754 SB
Mathematical Programming Models in Water	W73-02662 2A	SUCCESSION
Resource Systems,		Ecology of Yellowstone Thermal Effluent
W73-03232 6A	A Methodology for Estimating the Benefits to	Systems: Net Primary Production and Species
	Irrigated Agriculture from Increased Accuracy	Diversity of a Successional Blue-Green Algal
Stochastic Analysis of Hydrologic Systems,	in Seasonal Streamflow Forecasts,	Mat, W73-02980 SC
W73-03235 2A	W73-03130 3F	W 13-02980 3C

TASTE Influen and Dep W73-02 TEA D The Ex Yields i W73-02 TECHNO Techno Interfac W73-02 Village W73-02 TECHNO Techno Interfa W73-02 The Tr Enviro W73-02 TELLUR Jet Bo ing Str W73-0 TEMPER Observ Therm W73-0 The Is Relatio Tempe lus edi W73-0 Tempe tertida W73-0 Thern Plant Result W73-0 Biolog W73-4 Influe and D W73-TEMPE A P Chan W73-An I Wate W73-TEMPE Temp tertid W73-

TEMPI Biolo

Sciendards W73

Substances in Certain Biocoenoses in the Southern Taiga, (In Russian),

21

W73-02688

SUCCESSIVE APPROXIMATIONS TECHNIQUES

SUCCESSIVE APPROXIMATIONS	Water for Industrial Development in Copiah	SWEET POTATOES D
Optimal Operation of Serially-Linked Water	and Simpson Counties, Mississippi, W73-02651 3E	A Physiological Study on Variations of Dry Matter Percent of Tuber in Sweet Potatoes (In
Reservoirs, W73-02707	Contemporary Sources and Geochemistry of Tritium in the Gulf of Mexico and its Distribu-	Japanese), W73-02692 3F
NAME OF TAXABLE PARTY O	tive Province.	SYMBIOSIS
EUCKERS Effects of Hydrogen Sulfide on Fish Eggs and	W73-02730 5B	Nutrient Status and Mycorrhizal Enhancement
Fry, W73-03164 5C	Water for a Rapidly Growing Urban Communi-	of Water Transport in Soybean, W73-03087
TOTAL OF A PURP	tyOakland County, Michigan, W73-02804 3D	SYMPOSIUM
Effect of an Asphalt Barrier on Water Redis-		Round Table Meetings on the Deterioration of
tribution after Infiltration in Sandy Soils,	Water Resources of the Uspenskiy Mining Dis- trict and a Technical and Economic Justifica-	the Environment; Conference (In Spanish).
W73-03189 2G	tion of Their Use (Vodnyye resursy Uspen-	W73-03195 6G
SUGAR BEETS	skogo rudnogo poyasa i tekhniko-	Environmental Geochemistry in Health and
Interaction of Temperature and Salinity on	ekonomicheskoye obosnovaniye ikh ispol'- zovaniya).	Disease.
Sugar Beet Germination,	20vamya), W73-02814 4B	W73-03196 5B
W73-03084 3C	STORIAL NO.	SYSTEMATICS
ULFATES	Maximum Concentration of Dissolved solids in	Some Species of Phyllodocidae, Syllidae,
Isopiestic Determination of Solubilities in	Surface Water, Hartford North Quadrangle,	Nephtyidae, Goniadidae, Apistobranchidae and
Mixed Salt Solutions. Two Salt Systems,	Connecticut, W73-03155 7C	Spionidae (Polychaeta) from the Northeast
W73-03063 2K	W73-03155 7C	Pacific Ocean,
RULFITE LIQUORS	Preliminary Analysis of Surface Water Availa-	W73-03221 5B
On the Phytopiankton of Waters Polluted by a	bility,	SYSTEMS ANALYSIS
Sulphite Cellulose Factory,	W73-03233 4A	Systems Analysis and Water Quality Manage-
W73-02979 5C	SURFACES	ment,
(2) and egd/integer	Heat Balance of the Kara-Batkak Glacier Sur-	W73-02943 5G
Effluent and Water Quality Control of a	face During an Ablation Season (Teplovoy	Systems Approach to Problems of Water Pollu-
Synthetic Fiber Pulp Mill (Abwasser Und Gewaesserschutz Einer Kunstfaserzelistof-	balans poverkhnosti lednika Kara-Batkak v	tion Control.
fabrik),	period tayaniya), W73-02638 2C	W73-03222 5G
W73-03157 5D	CONTRACTOR AND ADDRESS OF THE PROPERTY ADDRESS OF THE PROPERTY AND ADDRESS OF THE PROPERTY ADDRESS OF THE PROPERTY AND ADDRESS OF THE PROPERTY ADDRESS OF THE	C
	SURGES	Systems Approaches to Microscale Problems of Water Pollution Control.
SUNFISHES	Experimental Investigation of Hydraulic	W73-03223 5G
Application of Biological Monitoring Systems to Simulated Industrial Waste Discharge Situa-	Transients in River-Reservoir Systems, Phase	
tions.	W73-02706 8B	Systems Approach to Water Pollution Control -
W73-02617 5C	Weet-Jakes Hunday Level in a 1971 from	A Discussion, W73-03224 5G
SOLVANIM TANGETHER	The Magnitude of Shear Stresses Acting on the	W 13-03224
SUNFLOWER D Irrigation of Maize and Sunflower Grown as	Bottom of Open Channels by Propagating Surge Waves,	The Miami Conservancy District Experience in
Post-Harvest Silage Crops in the Region of	W73-03038 8B	the Systems Approach to Water Quality Im-
Rossitza Irrigation System,	A THEORY OF STREET ASSESSMENT A	provement, W73-03225 5G
W73-02670 3F	SURVEYS	W 13-03223
SUPERCRITICAL FLOW	Environmental Monitoring Report: July- December 1971 and 1971 Summary,	Preliminary Analysis of Surface Water Availa-
Role of Vertical Shafts in the Movement of	W73-02709 5B	bility,
Ground Water in Carbonate Aquifers,	War how of the bury out the Park	W73-03233 4A
W73-02803 2F	Radioactivity of Waters in Northeastern Part of	Stochastic Analysis of Hydrologic Systems,
THE REPORT OF THE PARTY OF THE	Atlantic Ocean, W73-02710 5B	W73-03235 2A
SURCHARGES Surcharges and Stream Charges as Economic		Systems Approach to Designal Water Harris
Incentives.	West Valley Reprocessing Plant. Environmen- tal Report No. 11, 2nd Half 1971,	Systems Approach to Regional Water Use and Demand.
W73-03190 5G	W73-02712 5B	W73-03238 6A
TIPE IN THE PROPERTY OF THE PARTY OF THE PAR		TABANIDAE
Hydrodynamic Wave Uplift Forces on	SURVEYS (DATA COLLECTION) Comprehensive Survey of Elk River Basin.	Distribution and Seasonal Occurrence of
Horizontal Slabs.	Volume II, Economic Base Study,	Tabanidae along a Transect of South Carolina,
W73-03034 8B	W73-02860 6D	W73-03156 5B
Non-Steady Flow on Sloping Beach with Large	A STATE NAME OF THE PARTY OF TH	TAGANROG BAY (USSR)
Roughness Elements,	SUSPENDED SOLIDS Methods for the Characterization of Suspended	The Role of Zoobenthos in the Feeding of Bot-
W73-03040 2E	Methods for the Characterization of Suspended Sediment and Selected Applications for the	tom-Feeding Fish and the Food Supply After
1897012.46	Acquired Data,	the Damming of the Don (In Russian),
SURFACE DRAINAGE	W73-02977 5B	W73-02677 2L
Patterns of Drainage Areas With Random Topology,	SUSPENSION	TARITI
W73-03075 4A	Transport Processes of Particles in Dilute	Study of the Pollution of the Lagoon at Tahiti
True Mandali wang	Suspensions in Turbulent Water Flow - Phase	by Fecal Germs (In French),
SURFACE WATERS	II, decorate and a second of the second of t	W73-03181 5B
Control of Mercury Pollution in Sediments.	W73-02605	TARCA of subula procharged to be about the
W73-02632 5G	SUSSEX COUNTY (DEL)	TAIGA Water Consumption in the Growth of Organic
ment and a second and a second as a second as	DODDER COUNTY (PEE)	Consumption in the Otowin of Organic

The Availability of Ground Water in Eastern Sussex County, Delaware, W73-02805 4B

W73-02643

Water Resources Data for Colorado, 1971: Part

1. Surface-Water Records.

TASTE	TENNESSEE	THE NETHERLANDS
Influence of Temperature on Taste Intensity	Missouri (Analysis of State Water Pollution	Electrical Energy Needs and Environmental
and Degree of Liking of Drinking Water,	Law and Comparison with Present and	Problems, Now and in the Future.
W73-02779 5F	Proposed Tennessee Law),	W73-02768 5C
ALL PROPERTY AND ADDRESS OF THE PARTY AND ADDR	W73-03217 6E	Dialogical Effects of Cooling Water Discharge
TEAD The Effects of Water Availability on Tea	TERMINAL MORAINES	Biological Effects of Cooling Water Discharge, W73-02772 5C
Yields in Uganda,	Mechanism of the Formation of Some 'Ter-	30
W73-02696 3F	minal Moraines' and Role of Water in Glacial	THEORETICAL ANALYSIS
	Erosion (Mekhanizm obrazovaniya nekotorykh	Environmental Planning and Ecological Possi-
TECHNOLOGY	'konechnykh moren' i rol' vodnoy erozii v dinamike lednika),	bilities, W73-03184 6G
Technology Transfer in Water Research-The	W73-02642 2C	W73-03184 . 6G
Interface Between Producers and Users. W73-02877 6B	Charles and the same of the sa	THERMAL ACCLIMATION
W13-02011	TERMINOLOGY	The Influence of Thermal Acclimation on the
Village Technology Handbook.	A Glossary of Coastal Engineering Terms.	Relation Between Oxygen Consumption and
W73-02922 8A	W73-02654 8B	Temperature in Littorina littorea (L.) and Myti-
TECHNOLOGY TRANSFER	TERRACES (GEOLOGIC)	lus edulis L., W73-02760 5C
Technology Transfer in Water Research-The	Pediments and Terraces along the Moapa Val-	A SHARLEST AND ADDRESS OF THE RESERVE AND ADDRES
Interface Between Producers and Users.	ley, Clark County, Nevada,	THERMAL CONDUCTIVITY
W73-02877 6B	W73-03146 2J	A Method for the Determination of the Ther-
	TERRESTRAL POLLUTION	mal Properties of Soil Near the Surface, W73-03076 2G
The Transfer of Water Research Output by the	Environmental Radiation Dosimetry Near	W 73-03070 23
Environmental Protection Agency, W73-02879 6B	Large Nuclear Power Stations,	THERMAL EFFECTS
W73-02879 6B	W73-02742 5B	Thermal Effects of the Surry Nuclear Power
TELLUROMETER	TERTIARY TREATMENT	Plant on the James River, Virginia; Part II:
Jet Boat - Tellurometer Technique for Measur-	'Apollo County Park', Waste Water Reclama-	Results of Monitoring Physical Parameters of the Environment Prior to Plant Operation,
ing Streamflow in Large Rivers,	tion Project for the Antelope Valley Area, Los	W73-02767 5C
W73-02646 7B	Angeles County.	
TEMPERATURE	W73-02867 5D	THERMAL POLLUTION
Observations and Other Characteristics of	Capital and Operating Costs for Conventional	Diffusion of Thermally Buoyant Water Jets
Thermals.	and Advanced Waste Treatment.	into a Moving Water Stream, W73-02627 5B
W73-02757 8B	W73-02913 5D	W 13-02621
	TEST WELLS	Temperature Sensitivity of Two Species of In-
The Influence of Thermal Acclimation on the	Location of Wells and Test Holes, Hartford	tertidal Fishes,
Relation Between Oxygen Consumption and	North Quadrangle, Connecticut,	W73-02762 5C
Temperature in Littorina littorea (L.) and Myti- lus edulis L.,	W73-03153 7C	A Method for Calculating the Size of Cooling
W73-02760 5C	TEXAS	Tower Plumes,
	The Composition and Distribution of the Fish	W73-02763 5G
Temperature Sensitivity of Two Species of In-	Fauna of the Navasota River,	Counties The All In One Musican Dawn
tertidal Fishes, W73-02762 5C	W73-02613 · 8I	Sounding The All-In-One Nuclear Drum. W73-02764 5G
W 13-02/02	Annual Compilation and Analysis of Hydrolog-	
Thermal Effects of the Surry Nuclear Power	ic Data for Urban Studies in the Dallas, Texas	Biological Aspects of Thermal Pollution, II.
Plant on the James River, Virginia; Part II:	Metropolitan Area, 1970,	Scientific Basis for Water Temperature Stan-
Results of Monitoring Physical Parameters of	W73-02652 7C	dards at Power Plants, W73-02766 5C
the Environment Prior to Plant Operation,	Chemical and Bacteriological Quality of Water	W 13-02100
W73-02767 5C	at Selected Sites in the San Antonio Area, Tex-	Electrical Energy Needs and Environmental
Biological Effects of Cooling Water Discharge,	as, August 1968-April 1972,	Problems, Now and in the Future.
W73-02772 5C	W73-02808 5B	W73-02768 5C
Tofference of Temperature or West Living	Development of Ground-Water Resources in	Discharge of Waste Heat,
Influence of Temperature on Taste Intensity	the Orange County Area, Texas and Louisiana,	W73-02770 5C
and Degree of Liking of Drinking Water, W73-02779 5F	1963-71,	** *** ** *** *** *** *** *** ***
JF	W73-03139 4B	Handling Hot Water, With A Payoff, W73-02780 SG
TEMPERATURE CONTROL	Annual Compilation and Analysis of Hydrolog-	W73-02780 5G
A Plastic Inflated Environmental Growth	ic Data for Cow Bayou, Brazos River Basin,	Turbulent Thermal Diffusion of a Slot Jet
Chamber,	Texas, 1970,	Flowing into a Moving Stream,
W73-03095 3F	W73-03147 7C	W73-02895 5B
An Integrated System for Providing Power,	Annual Compilation and Analysis of Hydrolog-	Pollution Policy.
Water and Food for Desert Coasts,	ic Data for Urban Studies in the San Antonio.	W73-02959 5G
W73-03099 3F	Texas Metropolitan Area, 1970,	and the said the said and the said the said to
TEMPERATURE SENSITIVITY	W73-03148 7C	The Interaction of Sewage, Thermal, and Acid Mine Water Loadings on the Growth of
Temperature Sensitivity of Two Species of In-	Texas (Analysis of State Water Pollution Law	Mine Water Loadings on the Growth of Chlorella,
tertidal Fishes,	and Comparison with Present and Proposed	W73-02974 5C
W73-02762 5C	Tennessee Law),	
APPEAR OF THE PARTY OF THE PART	W73-03219 6E	THERMAL POWERPLANTS
TEMPERATURE STANDARDS		Thermal Effects of the Surry Nuclear Power Plant on the James River, Virginia; Part II:
Biological Aspects of Thermal Pollution, II. Scientific Basis for Water Temperature Stan-	THAMES RIVER Control of Thermal Stratification in Thames	Results of Monitoring Physical Parameters of
dards at Power Plants,	Valley Reservoirs,	the Environment Prior to Plant Operation,
W73-02766 5C	W73-02778 5B	W73-02767 5C
The state of the s	The state of the s	

THERMAL POWERPLANTS

Electrical Energy Needs and Environmental Problems, Now and in the Future.	The Significance of the Net Transfer of Viscous Stress Energy and the Local Produc-
W73-02768 5C	tion of Kinetic Energy in Stationary Soil Water
Electrical Energy, Demand and Supply,	Flow, W73-02821 2G
W73-02769 5C	A CONTRACTOR OF STREET OF STREET OF STREET
ATTO UT	THERMOPLASTIC RESINS
Air Pollution from Combustion Products, W73-02771 5C	Wet Oxidation of Nylon 6,6 by the Rotating Disk Technique.
W13-02/11	W73-03186 5D
THERMAL SPRINGS	* HOLE TO BOY THE THIRD AND ADDRESS
Ecology of Yellowstone Thermal Effluent	THICKENER DESIGN
Systems: Net Primary Production and Species	Mechanisms of Sludge Thickening, W73-02948 5D
Diversity of a Successional Blue-Green Algal Mat,	113-023-10
W73-02980 5C	THIOL
Temperature by Little and Science (CO) with the par-	Process and a Product for the Purification of
THERMAL STRATIFICATION	Polluted Water from Heavy Metal Ions Present Therein,
The Decay and Stability of Internal Wave	W73-02992 5D
Modes in a Multisheeted Thermocline, W73-02759 5G	
W15-02155	THORIUM
Wave-Induced Boundary Layers in a Stratified	Origin of Manganese Nodules of the Pacific Ocean From Radioisotope Data,
Fluid,	W73-02752 5B
W73-02761 8B	contact theret there is the
Thermal Stratification and Thermocline Control	TIEN SHAN
in Storage Reservoirs,	Monitoring Groundwater Reservoirs in Pied- mont Plains of Tien Shan (Upravleniye
W73-02777 5B	rezhimom podzemnykh vod na predgornykh
Control of Thermal Stratification in Thames	ravninakh Tyan' -Shanya),
Valley Reservoirs.	W73-02815 4B
W73-02778 5B	TIEN SHAN MOUNTAINS
tel distribution of the cell is a possible of	Some Features of Tien Shan Glaciers (Nekoto-
Approximate Calculation of a Thermally	ryye zakonomernosti oledeneniya Tyan'-
Stratified Turbulent Boundary Layer in a Re-	Shanya).
gion Downstream. A Sharp Change in the Roughness of the Surface at Which Flow Takes	W73-02633 2C
Place.	Mass Budget of the Kara-Batkak Glacier on the
W73-03058 8B	Northern Slope of the Terskey Ala-Too Range
A second for Calculation and Jan 1997	(Byudzhet lednikov severnogo sklona khrebta
THERMAL STRESS Interaction of Temperature and Salinity on	Terskey Ala-Too na primere lednika Kara-Bat-
Interaction of Temperature and Salinity on Sugar Beet Germination,	kak), W73-02634 2C
W73-03084 3C	W 73-02034
le l	Ablation of the Semenov Glacier (Tayaniye led-
Culture, Reproduction, and Temperature	nika Semenova),
Tolerance of Pontoporeia affinis in the Labora- tory,	W73-02636 2C
W73-03168 5C	Rate of Movement, Ablation, and Dynamics of
	Some Glaciers of the Ak-Shiyrak Range
THERMAL TOLERANCE	(Skorostnoy rezhim, tayaniye i dinamika neko-
Culture, Reproduction, and Temperature Tolerance of Pontoporeia affinis in the Labora-	torykh lednikov massiva Ak-Shiyrak), W73-02637 2C
tory,	117 02007
W73-03168 5C	Dynamics and Structure of the Yuzhnyy In-
THERMAN WATER	yl'chek Glacier (Voprosy dinamiki i struktury lednika Yuzhnyy Inyl'chek),
THERMAL WATER Observations and Other Characteristics of	W73-02639 2C
Thermals.	16.001
W73-02757 8B	Secular Growth of Some Tien Shan Glaciers (O
	poluvekovom razvitii nekotorykh Tyan'-Shan'- skikh lednikov),
THERMALS	W73-02641 2C
Observations and Other Characteristics of Thermals,	Trans. 1970.
W73-02757 8B	TIEN SHAN MOUNTANINS Morphology of Glacial Lake Merzbacher and
	Mechanics of its Catastrophic Outburst (Mor-
THERMOCLINE	fologiya lednikovogo ozera Mertsbakhera i
The Decay and Stability of Internal Wave	mekhanizm yego katastroficheskikh proryvov),
Modes in a Multisheeted Thermocline, W73-02759 5G	W73-02640 2C
The second secon	TOBACCO-D
Thermal Stratification and Thermocline Control	Effects of Water Stress on the Resistance to
in Storage Reservoirs,	Uptake of Carbon Dioxide in Tobacco,
W73-02777 5B	W73-03193 3F
THERMODYNAMICS	TOPOGRAPHY
Thermodynamic Analogy of Mass Transport	Pediments and Terraces along the Moapa Val-
Processes in Porous Media,	ley, Clark County, Nevada,
W73-02819 2F	W73-03146 2J

Identification of Refinery Effluent Effect Upon the A W73-02609
A Laboratory Stu to Fresh Water In W73-02695
Petroleum Hydrod W73-02866
Toxicity and Spre W73-02903
Changes in the E (Ictalurus nebul Short and Long T W73-02947
Toxicity of Alumi Neutral and Basic W73-02951
Changes in the (Cyprinus Carpio Ammonium Liqu wodowej Karpis Wplywem Wody W73-03158
A Simple Techni Toxicants or Othe Interaction, W73-03161
An Approach to Fisheries, W73-03163
Effects of Hydro Fry, W73-03164
TOXICITY TESTS Culture of the Ye W73-02952
TRACE ELEMENT Instruction Manu by Trace Eleme Neutron Activation W73-02715
Feasibility Study Extraction and matography to Ma W73-02747
Columbia River Pacific: Chemics Progress Report, W73-02751
Trace-Metal Asso tic Marine Envir June 1971-May 19 W73-02754
The Contents of Podzolic Soils Fo the Poozer'e (La Russian), W73-03214
TRAFFICABILITY The Adria (Monfinational Waterwa W73-03230

TOXICITY	10000
Identification of Toxic Components in Oil	TRANSLO
Refinery Effluents and Determination of Their	Respons
Effect Upon the Aquatic Biota,	Growth
W73-02609 5A	W73-031
The state of the s	W 15-05
A Laboratory Study on the Toxicity of Dieldrin	Mineral
to Fresh Water Invertebrates,	from No
W73-02695 5C	W73-03
	1071-02
Petroleum Hydrocarbons and the Sea,	TRANSM
W73-02866 5C	Transm
Toxicity and Spreading of Oil in Sea Water,	Minimu
Toxicity and Spreading of Oil in Sea Water, W73-02903	W73-02
Account year to a few years	mn 4 None
Changes in the Blood of the Brown Bullhead	TRANSPI
(Ictalurus nebulosus (Lesueur)) Following	A Phys
Short and Long Term Exposure to Copper (II),	Matter Japanes
W73-02947 5C	W73-02
	W/3-02
Toxicity of Aluminum Hydroxide Complexes in	The In
Neutral and Basic Media to Rainbow Trout, W73-02951	I. Mic
W73-02951 5C	tions,
Changes in the Peripheral Blood in Carp	W73-02
(Cyprinus Carpio L.) Under the Influence of	4,475,10
Ammonium Liquor (Zmiany we Krwi Ob-	Water
wodowej Karpis (Cyprinus Carpio L.) Pod	ous Ex
Wplywem Wody Amoniakalnesj,	Water
W73-03158 5C	W73-0
The State of the S	A Con
A Simple Technique for Detecting Effects of	Woods
Toxicants or Other Stresses on a Predator-Prey	W73-0
Interaction,	26
W73-03161 5C	Droug
An Annual to the Dodler of Belleting and	of Oal
An Approach to the Problem of Pollution and	W73-0
Fisheries, W73-03163 5C	1 1900
W73-03163 5C	Salt 1
Effects of Hydrogen Sulfide on Fish Eggs and	Trans
Fry,	W73-0
W73-03164 5C	vacifiers.
	TRANSI
TOXICITY TESTS	Effect
Culture of the Yellow Perch in the Laboratory,	on Ca
W73-02952 5G	of Cit
IL STORE DESCRIPTION OF THE REPORT OF THE PARTY OF THE PA	113-
TRACE ELEMENTS	TRANS
Instruction Manual for Oil Slick Identification	Rotat
by Trace Element Patterns Measured with	tions,
Neutron Activation Analysis, W73-02715 5A	W73-
W73-02715	100
Feasibility Study of the Application of Solvent	TRANS
Extraction and Gas-Liquid Partition Chro-	Com
matography to Marine Trace Metal Analysis,	Plant
W73-02747 5A	W73-
THE PROPERTY OF THE PARTY OF TH	TREAT
Columbia River Effects in the Northeast	
Pacific: Chemical and Geological Studies.	FWQ
Progress Report, Sept. 1971 to May 1972.	Desig W73-
W73-02751 5B	1175
Trace-Metal Associations in Sub-Artic and Arc-	TRICH
tic Marine Environments - Progress Report,	Stud
June 1971-May 1972,	Uppe
W73-02754 5B	lunat
to any a frequently that of the enquester	W73-
The Contents of Trace Elements in Eroded Sod	-011901
Podzolic Soils Formed on Morainic Deposits in	TRIIO
the Poozer'e (Lake Area) of Belorussia (In	The
Russian),	Triio
W73-03214 2G	Sele
TRAFFICABILITY	W73
The Adria (Monfalcone) - Danube Basin Inter-	TRITI
national Waterway.	Bibli
W73-03230 4A	torin

TRITION Bibliotorin W73

TRANSLOCATION	Tritium in Investigation of Surface Hydrology.	The Structure of Turbulent Flows Adjacent to
Response of Osmotically Stressed Plants to	Experimental Determination of Coefficient of Runoff.	Walls, W73-03060 8B
Growth Regulations, W73-03104 3C	W73-02713 5B	A STATE OF THE PARTY OF THE PAR
#75-05104	HARRIST MINISTER COMMISSION OF STREET	TURBULENT BOUNDARY LAYERS
Mineral Ion Composition of Halophytic Species	Tritium and Its Effects in the Environment - A	Approximate Calculation of a Thermally Stratified Turbulent Boundary Layer in a Re-
from Northern Utah, W73-03117 2I	Selected Literature Survey. W73-02720 5C	gion Downstream. A Sharp Change in the
W/3-0311/	11770	Roughness of the Surface at Which Flow Takes
TRANSMISSION (ELECTRICAL)	Contemporary Sources and Geochemistry of	Place,
Transmission Goals: Maximum Rating With	Tritium in the Gulf of Mexico and its Distribu- tive Province,	W73-03058 8B
Minimum Environmental Impact, W73-02843 8C	W73-02730 5B	Experimental Study of the Structure of Turbu-
W 73-02843	A CONTRACT OF CONTRACT OF THE PERSONS	lent Boundary Layers in Incompressible Fluids
TRANSPIRATION	TROUT	in the Presence of a Longitudinal Pressure
A Physiological Study on Variations of Dry	Raising Salmon in the Inland Waters of Japan, (In Russian).	Gradient, W73-03061 8B
Matter Percent of Tuber in Sweet Potatoes (In	W73-02899 8I	
Japanese), W73-02692 3F		TURBULENT FLOW
W/3-02092	An Approach to the Problem of Pollution and	Transport Processes of Particles in Dilute Suspensions in Turbulent Water Farm - Phase
The Influence of Mist Irrigation on the Potato	Fisheries, W73-03163 5C	II,
I. Micro-Environment and Leaf Water Rela-	1/	W73-02605 8B
tions, W73-02888 3F	Effects of Hydrogen Sulfide on Fish Eggs and	Diffusion of Thermally Bresset Water Late
W 73-02000 3F	Fry,	Diffusion of Thermally Buoyant Water Jets into a Moving Water Stream,
Water Loss From Leaves as Affected by Previ-	W73-03164 5C	W73-02627 5B
ous Exposure in an Atmosphere Saturated with	TUBER	m + 1 - m - 1 m/m - 1 m/m - 1 - 01-1 Y-1
Water Vapor, W73-02925 2D	A Physiological Study on Variations of Dry	Turbulent Thermal Diffusion of a Slot Jet Flowing into a Moving Stream,
W73-02925 2D	Matter Percent of Tuber in Sweet Potatoes (In	W73-02895 5B
A Contribution to the Study of Transpiration in	Japanese), W73-02692 3F	
Woody Species (In Czech.),	W15-02052	Mechanical Action of Non-Stationary Flow of
W73-02950 2D	TUGOR	Water on Porous Bodies and Through Struc- tures,
Drought Resistance and Internal Water Balance	The Influence of Mist Irrigation on the Potato	W73-03042 8B
of Oak Seedlings,	 Micro-Environment and Leaf Water Rela- tions, 	Commission Valories Distributions in Tradulant
W73-03199 2D	W73-02888 3F	Concerning Velocity Distributions in Turbulent Flow at Porous Surfaces.
Salt Migration into the Atmosphere During	Washington and American	W73-03059 8B
Transpiration,	TURBINE EFFICIENCY A New Approach to Efficiency Guarantees,	
W73-03206 2D	W73-02842 8C	The Structure of Turbulent Flows Adjacent to Walls,
worthmy Eldman V. Spores VI. small). Au-6-7-1		W73-03060 8B
TRANSPIRATION SUPPRESSANTS Effect of Several Transpiration Suppressants	TURBINES	
on Carbon Dioxide and Water Vapor Exchange	Moment Characteristics of Cascades Under Nonstationary Flow Conditions,	TURBULENT PARTICULATE TRANSPORT Transport Processes of Particles in Dilute
of Citrus and Grapevine Leaves,	W73-03029 8B	Suspensions in Turbulent Water Flow - Phase
W73-03192 2D	and a first the first work that a fixed A	II,
TRANSPORT PROPERTIES	Calculation of Generalized Hydrodynamic Forces for Kaplan Turbine Blades Oscillating	W73-02605 8B
Rotational Stability in Dilute Polymer Solu-	in the Liquid Flow,	TURKMENISTAN
tions,	W73-03030 8B	Soils of Northern Turkmenistan and Some of
W73-02874 2E	TURNIU PACE	their Agricultural Features (In Russian),
TRANSPORTATION	TURBULENCE Measurements of Turbulence in Water at High	W73-03210 2G
Community Values: A Strategy for Project	Velocity,	TURNING BASIN
Planning,	W73-02790 2E	Fall River Harbor, Massachusetts and Rhode
W73-02854 6B	Flow-Induced Dynamic Pressures on Square-	Island (Draft Environmental Impact State- ment).
TREATMENT FACILITIES	Section Cylinders,	W73-03144 8A
FWOA Sets Rules for Sewage Treatment Plant	W73-03022 8B	
Design.	Drag Coefficient and Turbulence Charac-	UGANDA The Effects of Water Availability on Tea
W73-02958 5D	teristics.	Yields in Uganda,
TRICHOPTERA	W73-03023 8B	W73-02696 3F
Studies on the Productivity of the Ponds of	Wake Dynamics of Two-Dimensional Struc-	UKRAINE
Upper Belgium: The Biology of Limnephilus	tures in Confined Flows.	Pepper Yield As Affected by
lunatus Curtis (Trichoptera),	W73-03024 8B	Hydrometeorological Factors (In Russian),
W73-02689 2I		W73-02674 3F
TRIIODIDE	The Frequency of Oscillating Forces Acting on Bluff Cylinders in Constricted Passages.	UKRAINIAN
The Use of Quaternary Ammonium Resin-	W73-03025 8B	Modes of Bog Development in the Ukrainian
Triiodide Complex to Inactivate Virus and		Carpathians (In Russian),
Selected Bacteria, W73-03188 5F	Amplitude-Dependent Frequency of An Oscil-	W73-02693 4A
W73-03188 5F	lating Cylinder in a High-Velocity Flow, W73-03026 8B	UKRAINIAN POLESIE
TRITIUM		Contents of Oxygen in Soil Water and CO2 in
Bibliography on Handling, Control and Moni-	Accelerated Motion of a Sphere in an Oscillat-	Soil Air in Forest Bogs of the Central Ukraini-
toring of Tritium (Dec. 1968-Jan. 1972), W73-02708	ing Fluid, W73-03028 8B	an Poleste (In Ukranian), W73-03091 4A
W73-02708 5B		

USE RAT

Water W73-0 USSR Some

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UKRAINIAN SSR The Effect of Drought on Potato Yields in the	Loss of Pressure Due to Periodic Movement of an Obstacle (Sur la perte de charge due a un
Ukrainian SSR (In Russian),	obstacle en mouvement periodique),
W73-02690	W73-03020 8B
ULTRA HIGH VOLTAGE	Extension of the Flow-Net Method to Un-
Transmission Goals: Maximum Rating With Minimum Environmental Impact,	steady Internal and External Flows, W73-03027 8B
W73-02843 8C	
ULTRAFILTRATION	Moment Characteristics of Cascades Under Nonstationary Flow Conditions,
Concentration of Viruses by Osmotic Ultrafil-	W73-03029 8B
tration: A Preliminary Report on the Develop-	Calculation of Generalized Hydrodynamic
ment of a Model System, W73-03176 5A	Forces for Kaplan Turbine Blades Oscillating
ULTRASTRUCTURE	in the Liquid Flow, W73-03030 8B
Effects of Streptomycin on the Ultrastructure	
of Plastids in Euglena,	Forces Exerted on Small Structures by a Fluid with a Free Surface in Alternating Movement
W73-02972 5C	(efforts exerces par un fluide a surface libre en
UMPQUA RIVER BASIN (OREG)	mouvement alternatif sur des structures fines), W73-03039
Flood Profiles in the Umpqua River Basin, Oregon, Part I,	Littary of Myboger Schule as Pali Eggs and
W73-02660 7C	Hydrodynamic Forces Caused by Unsteady Slot Flow on Vertical Leaf Gates,
UNDERGROUND	W73-03045 8B
Long Term Release of Radioactivity from	* 11/1/1/17
Rainier Melt-Glass,	UPLIFT PRESSURE Damage to Karnafuli Dam Spillway,
W73-02727 5B	W73-02787 8B
UNIFORM FLOW	UPPER KLAMATH LAKE (ORE)
Dispersion of Contaminated Bed-Load Parti-	Solubilization of inorganic phosphate by bac-
cles, W73-02650 5B	teria isolated from upper Klamath Lake sedi-
	ment, W73-02954 5C
UNIT HYDROGRAPHS	
Flood Hydrographs for Ungaged Streams, W73-02880 2E	URANIUM RADIOISOTOPES
	Uranium Concentration in Recent Ocean Sedi- ments in Zones of Rising Currents,
UNIT PROCESSES Water-Treatment-Plant Waste Disposal-Action	W73-02748 5B
Now,	Origin of Manganese Nodules of the Pacific
W73-02964 5F	Ocean From Radioisotope Data,
UNITED STATES	W73-02752 5B
A Land-Use Classification System for Use	URBAN HYDROLOGY
With Remote-Sensor Data, W73-02649 7B	Annual Compilation and Analysis of Hydrolog- ic Data for Urban Studies in the Dallas, Texas
	Metropolitan Area, 1970,
UNITED STATES NAVY The Containment and Recovery of Navy Oil	W73-02652 7C
Spills-A Financial Analysis,	Urban Sedimentation-In Perspective,
W73-02909 5G	W73-02793 2J
UNIVERSITY OF CONNECTICUT	Annual Compilation and Analysis of Hydrolog-
Water Research at the University of Connec-	ic Data for Urban Studies in the San Antonio,
ticut. W73-02631 9A	Texas Metropolitan Area, 1970,
	W73-03148 7C
UNIVERSITY OF NEW HAMPSHIRE	URBAN SEDIMENTATION
A Six-Year Review. W73-02655 9A	Urban SedimentationIn Perspective, W73-02793 2J
This parties to the second of the second of	TANK SHAW AND DAY AND DAY AND ADDRESS OF THE PARTY OF THE
UNSATURATED FLOW The Flow of Air and Water in Partly Saturated	URBAN SOCIOLOGY The River Basin Model: The Social Science
Clay Soil,	Laboratory.
W73-02834 2G	W73-02853 6B
Hydrostatics and Hydrodynamics in Swelling	URBANIZATION
Media,	Water for a Rapidly Growing Urban Communi-
W73-02837 2G	tyOakland County, Michigan, W73-02804 3D
Boundary Effects in Desaturation of Porous	The same of the sa
Media,	Water and Our Future: An Urban Planning
W73-03064 2G	Manual for Local Officials,

W73-02946

Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed,

	1
The Impact of Water Development on the Ecology of River Systems, W73-03068 5B	I
	1
SE RATES . Water Resources Management in Delaware, W73-02622 6B	I
SSR	п
Some Features of Tien Shan Glaciers (Nekotoryye zakonomernosti oledeneniya Tyan'-Shanya).	١
W73-02633 - 2C	1
Mass Budget of the Kara-Batkak Glacier on the Northern Slope of the Terskey Ala-Too Range (Byudzhet lednikov severnogo aklona khrebta Terskey Ala-Too na primere lednika Kara-Bat- kak),	
W73-02634 2C	-1
Water Balance of the Kara-Batkak Glacier Basin (Vodnyy balans lednikovogo basseyna na primere lednika Kara-Batkak),	
W73-02635 2C	-1
Ablation of the Semenov Glacier (Tayaniye led- nika Semenoya),	١
W73-02636 2C	
Rate of Movement, Ablation, and Dynamics of Some Glaciers of the Ak-Shiyrak Range (Skorostnoy rezhim, tayaniye i dinamika neko- torykh lednikov massiva Ak-Shiyrak), W73-02637 2C	
Heat Release of the Kara Rethal Glasies Sur-	
Heat Balance of the Kara-Batkak Glacier Sur- face During an Ablation Season (Teplovoy balans poverkhnosti lednika Kara-Batkak v period tayaniya),	
W73-02638 2C	
Difference of the statement of the state	
Dynamics and Structure of the Yuzhnyy In- yl'chek Glacier (Voprosy dinamiki i struktury lednika Yuzhnyy Inyl'chek),	
W73-02639 2C	- 1
Morphology of Glacial Lake Merzbacher and Mechanics of its Catastrophic Outburst (Mor- fologiya lednikovogo ozera Mertsbakhera i mekhanizm yego katastroficheskikh proryyov), W73-02640 2C	
Secular Growth of Some Tien Shan Glaciers (O	
poluvekovom razvitii nekotorykh Tyan'-Shan'-skikh lednikov),	
W73-02641 2C	
Mechanism of the Formation of Some 'Ter- minal Moraines' and Role of Water in Glacial Erosion (Mekhanizm obrazovaniya nekotorykh 'konechnykh moren' i rol' vodnoy erozii v dinamike lednika),	
W73-02642 2C	
Regional Hydrogeologic Investigations in Kazakhstan (Regional'nyye gidrogeologicheskiye issledovaniya v Kazakh-	
sta	
W73-02809 4B	
Groundwaters of Kazakhstan and Recommendations Regarding Their Use in the National Economy for 1976-80 (Podzemnye vody Kazakhstana i rekomendatsii po ikh ispol'zovaniyu v narodnom khozyaystve v period s 1976 po 1980 g.), W73-02810 4B	
Role of Groundwater in Maintaining the Level	
of Lake Balkhash (Rol' podzemnykh vod v podderzhanii urovnya oz. Balkhash),	
W73-02811 4B	

Prospec

Econom nykh narodno W73-02

Mineral Caspian vostoch W73-02

Water

trict ar tion of skogo ekonon zovani W73-07

Monito

mont rezhim ravnin W73-0

Occur

garian

vod pr hunga W73-0

Groun Prosp (Podz tivy il W73-4

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Yugo W73-

Globs W73-

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Map Clou

W73

A N for 1 W73

VALU Mul Rela

Ore W7

VAPO

Iso Mix W7

VAPO Ox W7

UNSTEADY FLOW

Experimental Investigation of Effects of Un-steady Flows on a Submerged Cylinder, W73-03019

Prospects of Using Groundwaters' Along the Ir- tysh River Near Semipalatinsk in the National Economy (Perspektivy ispol'zovaniya podzem- nykh vod Semipalatinskogo Priirtysh'ya v	VARIETIES Salt Tolerance of Safflower Varieties (Carthamus tinctorius L.) During Germination, W73-03088 3C	Damping of Natural Vibrations of an Immersed Cylindrical Shell with Free Ends: Influence of Confinement of the Fluid by an Axial Shell (Amortissement des vibrations propres d'une
narodnom khozyaystve), W73-02812 4B	VEGETABLE CROPS Vegetable Production Under Plastic on the	coque cylindrique immergee et libre a ses deux extr emites: influence du confinement du fluide
Mineral Waters Along the Eastern Edge of the Caspian Lowland (Mineral'nyye vody	Desert Seacoast of Abu Dhabi, W73-03110 3F	par une coque axiale), W73-03052
vostochnoy okrainy Prikaspiyskoy vpadiny), W73-02813 4B Water Resources of the Uspenskiy Mining Dis-	VEGETATION Flood Plain Vegetation of the Middle Regions of the Kerulen River (From Information of the	Study of Viscous Hydraulic Dataping of Breathing Vibrations of a Cylindrical Shell in a Fluid at Rest (Etude de l'amortissement hydraulique visqueux des vibrations de respira-
trict and a Technical and Economic Justifica- tion of Their Use (Vodnyye resursy Uspen- skogo rudnogo poyasa i tekhniko-	Joint Soviet-Mongolian Complex Biological Ex- pedition of the Academy of Science of the USSR and the Academy of Science of the MP R, (In Russian),	tion d'une coque cylindrique dans un fluide au repos), W73-03053 8B
ekonomicheskoye obosnovaniye ikh ispol'- zovaniya),	W73-02882 2I	
W73-02814 4B	VEGETATION EFFECTS	Study of the Hydraulic Damping of the Vibra- tions of a Rod in the Turbulent Regime (Etude
Monitoring Groundwater Reservoirs in Pied- mont Plains of Tien Shan (Upravleniye	Vegetation, Runoff, and Sediment Yield Rela- tionships, W73-03067 5B	de l'amortissement hydraulique de la vibration d'une baguette en regime turbulent), W73-03054 8B
rezhimom podzemnykh vod na predgornykh ravninakh Tyan' -Shanya),		be brighted to the state of the principle and the
W73-02815 4B	VEGETATION-RUNOFF-SEDIMENT RELATIONSHIPS Vegetation, Runoff, and Sediment Yield Rela-	Critical Water Depth for Hydrodynamic In- duced Oscillation of Cantilevered Cylinders, W73-03055 8B
Occurrence of Groundwater in the Piedmont Alluvial Plain on the Northern Slope of Dzun-	tionships,	Control of the Association of the State of t
garian Ala Tau (Formirovaniye. podzemnykh	W73-03067 5B	Hydrodynamic Forces Acting on Sonic Oscilla- tors in Sonic Transmissions (Forces
vod predgornogo shleyfa severnogo sklona Dz- hungarskogo Alatau),	VELOCITY Rate of Movement, Ablation, and Dynamics of	hydrodynamiques agissant sur les oscillateurs
W73-02816 4B	Some Glaciers of the Ak-Shiyrak Range (Skorostnoy rezhim, tayaniye i dinamika neko-	soniques prevus dans les transmissions soniques),
Groundwater of the Akdala River Valley and Prospects of its Use as a Water-Supply Source	torykh lednikov massiva Ak-Shiyrak),	W73-03056 8B
(Podzemnyye vody doliny r. Akdala i perspek- tivy ikh ispol'zovaniya dlya vodosnabzheniya),	W73-02637 2C	VICTORIA GLACIER (CANADA) Glacier Surveys by District Personnel of the
W73-02817 4B	Dynamics and Structure of the Yuzhnyy In- yl'chek Glacier (Voprosy dinamiki i struktury	Water Survey of Canada: 1. The Victoria Glaci-
Underground Mineral Water of Alpine Regions of Southeastern Kazakhstan (Podzemnyye	lednika Yuzhnyy Inyl'chek), W73-02639 2C	er, W73-02648 2C
mineral'nyye vody vysokogornykh rayonov Yugo-Vostochnogo Kazakhstana),	Concerning Velocity Distributions in Turbulent Flow at Porous Surfaces,	VILLAGE TECHNOLOGY Village Technology Handbook.
W73-02818 4B	W73-03059 8B	W73-02922 . 8A
Global Hydrology, W73-03057 2A	VERTICAL SHAFTS (KARST) Role of Vertical Shafts in the Movement of Ground Water in Carbonate Aquifers,	VIRBRATIONS Theoretical Study on Flap Gate Oscillation, W73-03044 8B
UTAH	W73-02803 2F	Charles Color Continued to the Continued Long L
The Yellow Perch Fisheries of Deer Creek Reservoir, Utah, with Notes on Parasitism by	VIBRATIONS	VIRGINIA Thermal Effects of the Surry Nuclear Power
Ligula Intestinalis, W73-02701 8I	Hydrodynamic Forces Due to Nonstationary Oscillations of Cylindrical Shells in a Fluid Medium with Deformations of the Cross-Sec-	Plant on the James River, Virginia; Part II: Results of Monitoring Physical Parameters of the Environment Prior to Plant Operation,
Mineral Ion Composition of Halophytic Species from Northern Utah,	tion Taken into Account, W73-03047 8B	W73-02767 5C
W73-03117 21		VIRICIDES
Map Showing Drainage Basins and Historic Cloudburst Floods in the Salina Quadrangle,	Natural Vibrations of Cylindrical Shells in a Moving Fluid (Vibrations propres de coques cylindriques en presence de fluide),	The Use of Quaternary Ammonium Resin- Triiodide Complex to Inactivate Virus and Selected Bacteria,
Utah, W73-03152 7C	W73-03048 8B	W73-03188 SF
UTILITIES	On Hydroelastic Correlations Between Dif- ferent Forms of Oscillations of Plate in the	VIRUS SURVIVAL
A New Theory of Pricing and Decision-Making for Public Investment,	Flow Boundary Resulting from Non-Uniform Distribution of Averaged Flow Velocity in	Laboratory Studies on the Survival of Poliovirus in Algal-Bacterial Wastewater Treat-
W73-02917 - 6B	Depth, W73-03049 8B	ment Systems, W73-03178 5D
VALUE		VIRUSES
Multi-Disciplinary Study of Water Quality Relationships: A Case Study of Yaquina Bay, Oregon,	Investigation of Nonstationary Hydrodynamic Forces Induced by a Plate Oscillating in Liquid Flow (Two-Dimensional Problem),	Biologic Parameters in Water Transmission of Viruses,
W73-02921 , 5C	W73-03050 · 8B	W73-03173 5A
VAPOR PRESSURE	A Method Utilizing an Integral Formulation of	Detection of Viruses in Water: A Review of
Isopiestic Determination of Solubilities in Mixed Salt Solutions. Two Salt Systems,	Problems of Natural Vibrations of Shells in the Presence of an Incompressible Fluid (A propos	Methods and Application, W73-03174 5A
W73-03063 2K	d'une methode utilisant une formulation in- tegrale du probleme des vibrations propres de	Progress in the Development of an Apparatus
VAPORIZATION	coques en presence d'un fluide incompressi-	for Concentration of Viruses From Large Volumes of Water,
Oxidative Waste Disposal, W73-03008 5D	ble), W73-03051 8B	W73-03175 . 5A

Limesto Waters, W73-025

Neutral Wastes, W73-02

Remove W73-03 Biogrid W73-03

Remov Waste W73-03

Proces Waste-W73-0

Bioche ty Mol W73-0

Appar W73-0

Munic Water W73-0

Effluc Synth Gewa fabrik W73-

Labo Polio ment W73-Wet Disk W73-

Syste tion W73

Syst of W W73

Prog Man W73

WAST Mat and W7:

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Wa
Int
W7
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VIRUSES

Laboratory Studies on the Survival of Poliovirus in Algal-Bacterial Wastewater Treat- ment Systems,	WASTE ASSIMILATIVE CAPACITY Assimilation of a Wastewater Treatment Plant Effluent by the Asa Creek-Kaskaskia River	WASTE WATER TREATMENT A New Approach for Water Reclamation - Complete Treatment of Waste Water by
W73-03178 5D	System, Moultrie County, Illinois, W73-02887 5C	Physico-Chemical Processes, W73-02607 5D
VOLGA DELTA (USSR)	AND THE RESIDENCE OF THE PARTY	THE PARTY OF THE P
Determination of Optimal Proportions of Nitrogen and Phosphorus Contents Used for	WASTE DISPOSAL Shipboard Control of Wastes.	Optimal Conditioning Procedures for Waste Activated Sludge Disposal,
Pond Fertilization, (In Russian), W73-02681	W73-02902 5G	W73-02616 5D
W/3-02001	Cost Analysis of Optional Methods of Ship-	Anaerobic Treatment of Starch Wastewaters,
VOLGOGRAD RESERVOIR Natural Reroduction of Fish in the Volgograd	board Waste Disposal, W73-02916 5E	W73-02619 5D
Reservoir (In Russian),	A STATE OF THE STA	Chemical and Physical Factors in the Floccula-
W73-03102	Discussion of Waste Disposal in Arid Lands, W73-03129 5F	tion of Metal Plating Wastes with Polyelec- trolytes,
Number of Commercial Fish in the Volgograd	Study of the Pollution of the Lagoon at Tahiti	W73-02626 5D
Reservoir and Measures for Increasing Their Productivity, (In Russian),	by Fecal Germs (In French),	'Apollo County Park', Waste Water Reclama-
W73-03172 8I	W73-03181 5B	tion Project for the Antelope Valley Area, Los Angeles County.
VOLGOGRAD RESERVOIR (USSR)	WASTE DISPOSLA	W73-02867 5D
Feeding Rhythm of Sturgeon in the Volgograd	Sites of Solid-Waste Storage and Liquid-Waste Discharge, Hartford North Quadrangle, Con-	Chimograph as her section and possible
Reservoir, (In Russian), W73-02685	necticut,	The Effect of pH on Aerobic Sludge Digestion, W73-02897 5D
Blackman Fort C	W73-03154 7C	Characterization and Toursell Br
VOLO BOG BASIN (ILL)	WASTE HEAT	Characterization and Treatment of Bilge and Ballast Water.
Geology, Soils, and Hydrogeology of Volo Bog and Vicinity, Illinois.	Environmental Effects Specific to Nuclear	W73-02905 5G
W73-02657 2H	Power Production, W73-02774 5C	Pollution: Taxation or Purification.
substitutes along the street address.	#13-02114	W73-02911 5D
VORTICES	Handling Hot Water, With A Payoff,	35
Flow-Induced Dynamic Pressures on Square-	W73-02780 5G	Capital and Operating Costs for Conventional
Section Cylinders, W73-03022	WASTE HEAT USES	and Advanced Waste Treatment. W73-02913 5D
Obeger Surveys to Direct Personnel and the	Handling Hot Water, With A Payoff,	Over the land remained for any artists of the
Drag Coefficient and Turbulence Charac-	W73-02780 5G	Cost Allocation for A Regional Pollution Treat-
teristics, W73-03023	WASTE HEAT UTILIZATION	ment System,
J. North 2018 surnels for Carry and Physics	Electrical Energy Needs and Environmental	W73-02937 5G
Wake Dynamics of Two-Dimensional Struc- tures in Confined Flows,	Problems, Now and in the Future. W73-02768 5C	Mechanisms of Sludge Thickening,
W73-03024 8B	"ACO CETTO SCHOOL OF THE SECRETARIAN SPECIAL S	W73-02948 5D
The Frequency of Oscillation Forces Action on	Discharge of Waste Heat,	Pollution Hearing Sets a Southern Landmark.
The Frequency of Oscillating Forces Acting on Bluff Cylinders in Constricted Passages,	W73-02770 5C	W73-02960 5G
W73-03025 8B	WASTE LOAD Mathematical Models for Regional Economic	Salt Creek Two Stage Nitrification Plant,
Amplitude-Dependent Frequency of An Oscil-	and Waste Load Projection,	W73-02963
lating Cylinder in a High-Velocity Flow,	W73-02920 5B	Activated Sludge Processing,
W73-03026 8B	WASTE TRANSPORTATION	W73-02981 5D
Accelerated Motion of a Sphere in an Oscillat-	Waste Management,	Process of Purifying Water by Irradiating It,
ing Fluid,	W73-02734 SD	W73-02982 5D
W73-03028 8B	ACCOUNT TOUR RELEASE ACCOUNT.	The second secon
THE PARTY OF THE P	WASTE TREATMENT	Sewage Treatment System,
WABASH RIVER (IND) Nitrate Transformations in Surface Waters; I.	Cost Analysis of Optional Methods of Ship- board Waste Disposal,	W73-02983 5D
A Study of Various Factors Affecting the Rates	W73-02916 5E	Aerating Apparatus,
of Denitrification and Immobilization in Sur-	The second secon	W73-02984 5D
face Waters, and II. Characterization of the	Mathematical Models for Regional Economic	Sawage Treatment Appearatus
Surface Waters in the Wabash River and Three	and Waste Load Projection, W73-02920 5B	Sewage Treatment Apparatus, W73-02987 5D
Farm Ponds,	The state of the s	AND THE PROPERTY AND ADDRESS OF THE PARTY AND
W73-03191 5B	WASTE WATER DISPOSAL	Removal of Dissolved Oxygen from Water,
WALLEYE	Physico-Chemical Limnology and Periphyton in	W73-02988 5D
Effects of Hydrogen Sulfide on Fish Eggs and	a Warm-Water Stream Receiving Wastewater Treatment Plant Effluent,	Process for Detoxifying Cyanide Waste
Fry,	W73-02603 5D	Waters
W73-03164 5C	Description of the authority of the selection of the sele	W73-02989 5D
WARWICKSHIRE AVON RIVER	Systems Approach to Problems of Water Pollu-	· Zould-generalistic and ground worth, by terminational School
The Warwickshire Avon: A Case Study of	tion Control, W73-03222 5G	Removal of Phosphate from Waste Water, W73-02990 5D
Water Demands and Water Availability in an	THE RESIDENCE OF THE PROPERTY OF THE PARTY O	Actors Reporting Then Day in the Madding
Intensively Used River System, W73-03103 6D	A Branch-And-Bound Algorithm for Regional Water Quality Management,	Process and a Product for the Purification of Polluted Water from Heavy Metal Ions Present
	W73-03243 5G	Therein,
WASHINGTON		W73-02992 5D
Synoptic Measurements of Currents and Sedi- ment Transport on the Continental Shelf. An-	WASIE WAIER (FOLLUTION)	Neutralization of Farmers Inc. Contribute
ment Transport on the Continental Shell. Annual Progress Report,	What Water and Waste Water Parameters Should We Measure,	Neutralization of Ferrous Iron-Containing Acid Wastes.
W73-02716 2L	W73-02976 5A	W73-02993 5D
kingly (free law 5 free a filty of the	placed to be largered Ward help	publication or a filthest.

Limestone Neutralization of Dilute Acid Waste Waters,	Development of Analytical Procedures for Determining Chlorinated Hydrocarbon	Systems Approach to Regional Water Use and Demand.
W73-02994 5D	Residues in Waters and Sediments From	W73-03238 6A
Neutralization of Ferrous Iron-Containing Acid	Storage Reservoirs, W73-02844 SA	WATER DEMANDS
Wastes, W73-02995 5D	There I be on the said the said the	The Warwickshire Avon: A Case Study of Water Demands and Water Availability in an
45.00	Isopiestic Determination of Solubilities in Mixed Salt Solutions. Two Salt Systems,	Intensively Used River System,
Removal of Phosphates from Sewage Effluent, W73-03000 5D	W73-03063 2K	W73-03103 6D
The state of the s	WATER BALANCE	WATER DISTRIBUTION
Biogrid Unit and Method, W73-03001 5D	Water Balance of the Kara-Batkak Glacier Basin (Vodnyy balans lednikovogo basseyna na	An Experiment in Computer-Assisted Super- visory Control of a Water Distribution System,
Removal of Nitrogen and Phosphorus from	primere lednika Kara-Batkak),	W73-02871 4A
Waste Waters,	W73-02635 2C	WATER DISTRIBUTION (APPLIED)
W73-03002 5D	Glacier Surveys by District Personnel of the	Flood Control Storage Allocations by Linea Programming.
Process for Removing Contaminants from	Water Survey of Canada: 1. The Victoria Glaci- er,	W73-02667 4/
Waste-Water, W73-03003 5D	W73-02648 2C	A Businesslike Approach to Fire Prtoection
Biochemical Sewage Treatment Via High Puri-	Occurrence of Groundwater in the Piedmont	Charges. W73-02864 3I
ty Molecular Oxygen,	Alluvial Plain on the Northern Slope of Dzun- garian Ala Tau (Formirovaniye podzemnykh	
W73-03004 5D	vod predgornogo shleyfa severnogo sklona Dz-	MATER DISTRIBUTION (POLICY) Improved River Basin Utilization Through
Apparatus for Biologically Purifying Sewage,	hungarskogo Alatau), W73-02816 4B	Systems Analysis,
W73-03014 5D	Shall Spicially Break southern brogger	W73-02665
Municipal and Industrial Waste with Limited Water Resources,	Global Hydrology, W73-03057 2A	WATER ECONOMY (PLANTS) The Water Economy of the Bilberry (Vaccini
W73-03127 5F	A Self-Verifying Hybrid Computer Model of	um myrtillus) Under Winter Conditions,
Effluent and Water Quality Control of a	River-Basin Hydrology,	W73-02705
Synthetic Fiber Pulp Mill (Abwasser Und Gewaesserschutz Einer Kunstfaserzelistof-	W73-03183 2A	WATER LAW Adjudication Provisions Under the 1909 Water
fabrik),	Drought Resistance and Internal Water Balance	Code-Survey of Case Law and Proposals fo
W73-03157 5D	of Oak Seedlings, W73-03199 2D	Legislative Amendment, W73-02894 61
Laboratory Studies on the Survival of	WATER CHEMISTRY	WATER LEVEL EFFECTS
Poliovirus in Algal-Bacterial Wastewater Treat- ment Systems,	A Study on the Chemical Behavior of Zinc in	Natural Reroduction of Fish in the Volgogra
W73-03178 5D	Chesapeake Bay Water Using Anodic Stripping Voltammetry,	Reservoir (In Russian), W73-03102
Wet Oxidation of Nylon 6,6 by the Rotating	W73-02783 5B	Intragacional Contratt of the Contratt Contratt of the Contra
Disk Technique, W73-03186 5D	Mineral Waters Along the Eastern Edge of the	Number of Commercial Fish in the Volgogra Reservoir and Measures for Increasing Their
and the state of t	Caspian Lowland (Mineral'nyye vody	Productivity, (In Russian), W73-03172
Systems Approach to Problems of Water Pollu- tion Control.	vostochnoy okrainy Prikaspiyskoy vpadiny), W73-02813 4B	
W73-03222 5G	Underground Mineral Water of Alpine Regions	WATER LEVEL FLUCTUATIONS Hydrologic Reconnaissance of Big and Little
Systems Approaches to Microscale Problems	of Southeastern Kazakhstan (Podzemnyye	Soda Lakes, Churchill County, Nevada,
of Water Pollution Control, W73-03223 5G	mineral'nyye vody vysokogornykh rayonov Yugo-Vostochnogo Kazakhstana),	W73-03137
A DESCRIPTION OF THE PROPERTY	W73-02818 4B	Bathymetric Reconnaissance of Big and Little Washoe Lakes, Washoe County, Nevada,
Programming Model of Regional Water Quality Management,	Bioassays of Quality in Water Resources of	W73-03138 7
W73-03240 5G	Major Importance to New Mexico, W73-02876 5C	Development of Ground-Water Resources i
WASTES		the Orange County Area, Texas and Louisians 1963-71.
Mathematical Models for Regional Economic and Waste Load Projection,	WATER CONSUMPTION Water Consumption in the Growth of Organic	W73-03139 4
W73-02920 5B	Substances in Certain Biocoenoses in the	WATER LEVELS
WATER ALLOCATION	Southern Taiga, (In Russian), W73-02688 21	Effects of Reservoir Operating Policy of Recreation Benefits.
An Economic Analysis of Water-Use Regula-	WATER DEMAND	W73-02618 6
tion in the Central Ogallala Formation, W73-02892 4B	A Water Supply-Demand Analysis in Clinton	Role of Groundwater in Maintaining the Levi
WATER ALLOCATION (POLICY)	County, Pennsylvania: A Study in Economic Hydrology,	of Lake Balkhash (Rol' podzemnykh vod
The Warwickshire Avon: A Case Study of	W73-02610 6D	podderzhanii urovnya oz. Balkhash), W73-02811 4
Water Demands and Water Availability in an Intensively Used River System,	River Basin Modeling, an Approach to Com-	WATER MAIN CLEANING
W73-03103 6D	puter Simulation of the Bitterroot-Clark Fork	Cleaning Water Mains With Foam PlugsE
WATER ANALYSIS	River Basin. W73-02857 4A	perience at Washington, D. C., W73-02862
Feasibility Study of the Application of Solvent	Water Requirements of Santa Barbara County,	WATER MANAGEMENT (APPLIED)
Extraction and Gas-Liquid Partition Chro- matography to Marine Trace Metal Analysis,	1967 to 1990,	Water Resources Management in Delaware,
W73-02747 5A	W73-02868 6D	W73-02622

Bioass Major W73-02

Mather and W W73-0

Compi Param W73-0

Health W73-0

Munic Water W73-4

Agrice W73-1
Hydr Soda W73-1
Frau Water W73-1
Annuic D Text W73-1
Max W73-1
Biolo Virt W7-1
Det Me W7-1
Profor Vo W7-1
Gr W6-1
W7-1
W7-1
Gr W6-1
W7-1
W7-1
Solid W7-1

WATER MEASUREMENT

WATER MEASUREMENT Measurements of Turbulence in Water at High	tradioaktivitat in den Landern der Gemeinschaft im Jahre 1970: Luft	Troubled Waters, Lake Erie 1971, W73-02743 SB
Velocity,	Niederschlage-Wasser).	diversion of the second
W73-02790 2E	W73-02726 5B	Chemical and Bacteriological Quality of Water at Selected Sites in the San Antonio Area, Tex-
WATER METERING The Coming Technical Revolution in Meter	EPA, Environmental Legislation and Energy, W73-02739 5G	as, August 1968-April 1972, W73-02808 5B
Reading, W73-02863 7B	Troubled Waters, Lake Erie 1971,	Sources of Nutrients in Canadarago Lake,
WATER METERS	W73-02743 5B	W73-02859 5C
The Coming Technical Revolution in Meter	Petroleum Hydrocarbons and the Sea,	Water for Texas.
Reading, W73-02863 7B	W73-02866 5C	W73-03066 5B
and the second s	Engineers Score Federal Pollution Tactics.	The Impact of Water Development on Ecology
WATER POLICY Water Resources Management in Delaware,	W73-02961 5G	of the Gulf of Mexico,
W73-02622 6B	What Water and Waste Water Parameters	W73-03070 5B
	Should We Measure,	Remote Sensing of Water Pollution,
Water and Our Future: An Urban Planning Manual for Local Officials,	W73-02976 5A	W73-03132 5A
W73-02872 6B	Milwaukee Diked Disposal Area, Wisconsin,	WATER POLLUTION TREATMENT
Organizational Alternatives in Consolidating Ir-	(Draft Environmental Impact Statement). W73-03151 5G	Method and Apparatus for Removing Oil and Debris from Water,
rigation Systems, W73-03107 3F	Mind the last of Control William Particular	W73-02997 5G
College, Scill, sep U computing of Example,	Missouri (Analysis of State Water Pollution Law and Comparison with Present and	WATER POTENTIAL
WATER POLLUTION	Proposed Tennessee Law),	Which Water Potential. Differences Between
Radioactive Waste Repository, Lyons, Kansas, (Final Environmental Impact Statement).	W73-03217 6E	Isopiestic Thermocouple Psychrometer Mea-
W73-02721 5C	North Carolina (Analysis of State's Water Pol-	surements of Intact and Excised Plant Materi-
The second secon	lution Law and Comparison with Present and	als,
Environmental Radioactivity Measurement Ex- perience Near a Fuels Reprocessing Plant,	Proposed Tennessee Law),	W73-03096 7B
W73-02741 5B	W73-03218 6E	WATER PROPERTIES
T	Texas (Analysis of State Water Pollution Law	Underground Mineral Water of Alpine Regions
Troubled Waters, Lake Erie 1971, W73-02743 5B	and Comparison with Present and Proposed	of Southeastern Kazakhstan (Podzemnyye
to Meso-stw	Tennessee Law),	mineral'nyye vody vysokogornykh rayonov Yugo-Vostochnogo Kazakhstana),
Radioactive and Stable Nuclides in the Colum- bia River and Adjacent Northeast Pacific	W73-03219 6E	W73-02818 4B
Ocean,	WATER POLLUTION EFFECTS	WATER PURIFICATION
W73-02745 5B	Mercury Pollution of Golf Course Lakes, W73-02615 5B	The Preparation and Oxidative Properties of
Electrical Energy Needs and Environmental	100 100 100	Ferrate Ion (FeO42-). Studies Directed Toward
Problems, Now and in the Future.	Effects of Detergent Polluted Water on Soil Reaction and Plant Growth.	Its Use as a Water Purifying Agent, W73-02608 SF
W73-02768 5C	W73-02620 5C	ON TOWNS
Immediate Cost-Effective Abatement of Water	Was necessity of calco Philasulinian separate and	Desalting and Purifying Water by Continuous
Pollution from Navy Ships.	Symposium on Radioecology Applied to the	Ion Exchange, W73-02998 3A
W73-02901 5G	Protection of Man and His Environment, W73-02722 5B	W 15-025-0
Characterization and Treatment of Bilge and		Porous Support Tubes for Reverse Osmosis,
Ballast Water, W73-02905 5G	Distribution of Radioactivity in and Near the	W73-03009 3A
W15-02905	Rainier Rubble Chimney, W73-02723 5B	WATER QUALITY
Multi-Disciplinary Study of Water Quality	Com Main Description	A Comparison of Public and Resource Ad-
Relationships: A Case Study of Yaquina Bay, Oregon,	Long Term Release of Radioactivity from	ministrator Visual Perceptions of an Outdoor Water-Based Recreation Area,
W73-02921 5C	Rainier Melt-Glass, W73-02727 5B	W73-02612 6B
Literature Review: Economics.	The World and Projections	Strongs Comment Ligarities
W73-02934 5G	A Survey of Some Possible Effects of Logging on Two Eastern Vancouver Island Streams,	Modeling Discharge and Conservative Water Quality in the Lower Kansas River Basin,
	W73-03160 4C	W73-02658 4A
The Impact of Water Development on the Ecology of Bays and Estuaries,		Maria Cara Cara Cara Cara Cara Cara Cara
W73-03069 5B	WATER POLLUTION EVALUATION An Approach to the Problem of Pollution and	Integrated Management of Quantity and Quali- ty of Urban Water Resources,
Mine Circle Bookies Advantion on Coll Book V.	Fisheries.	W73-02666 5G
Virus-Sized Particle Adsorption on Soil-Part I: Rate of Adsorption,	W73-03163 5C	The state of the s
W73-03177 5B	WATER BOLL UTION COURCES	Water Resources Data for Georgia-1971.
VATES BOLL UTION ABATEMENT	WATER POLLUTION SOURCES The Occurrence and Possible Source of the	W73-02784 7C
Troubled Waters, Lake Eric 1971.	Coliform Bacteria on the Shoreline of Northern	Mineral Waters Along the Eastern Edge of the
W73-02743 5B	Lake Michigan,	Caspian Lowland (Mineral'nyye vody
WATER POLLUTION CONTROL	W73-02606 5B	vostochnoy okrainy Prikaspiyskoy vpadiny), W73-02813 4B
Control of Mercury Pollution in Sediments.	Mercury Pollution of Golf Course Lakes,	WYNAMES OF THE PERSON OF THE P
W73-02632 5G	W73-02615 5B	Underground Mineral Water of Alpine Regions of Southeastern Kazakhstan (Podzemnyye
Results of Environmental Radioactivity Mea-	Dispersion of Contaminated Bed-Load Parti-	mineral'nyye vody vysokogornykh rayonov
surements in the Community Countries in 1970:	cles,	Yugo-Vostochnogo Kazakhstana),
Air-Fallout-Water (Messwerte der Umwel-	W73-02650 5B	W73-02818 4B

	200000	WATER RESOURCES INSTITUTE
Bioassays of Quality in Water Resources of	Systems Approach to Water Pollution Control -	Some Problems of the Optimal Use of a Basin
Major Importance to New Mexico,	A Discussion.	Water Resources on the Basis of Mathematical
W73-02876 5C	W73-03224 5G	Modelling,
	MINISTRUMENTAL CONTRACTOR OF THE PROPERTY OF T	W73-03227 4A
Mathematical Models for Regional Economic	The Miami Conservancy District Experience in	
and Waste Load Projection,	the Systems Approach to Water Quality Im-	Optimization of Basin Water Resources Utiliza-
W73-02920 5B	provement,	tion, W73-03228 4A
Compilation of Water Quality Data and	W73-03225 5G	W73-03228 4A
Parameters from Kansas Rivers and Streams,	Programming Model of Regional Water Quality	Optimum Use of Water Resources of Basins in
W73-02973	Management.	Irrigation.
W 13-02913	W73-03240 5G	W73-03229 3F
Health Related Problems in Arid Lands.		
W73-03126 5F	Benefits of Flow Augmentation for Water	WATER RESOURCES DEVELOPMENT
	Quality Control,	Annual Report of Activities During Fiscal Year
Municipal and Industrial Waste with Limited	W73-03242 5G	1972.
Water Resources,	Physical Insert States	W73-02630 9A
W73-03127 5F	A Branch-And-Bound Algorithm for Regional	W
Warming Difference in Commence of Contra	Water Quality Management,	Water Research at the University of Connec-
Agricultural Wastes in Arid Zones,	W73-03243 5G	ticut.
W73-03128 5F	WATER OHAT ITV CTANDARDS	W73-02631 9A
	WATER QUALITY STANDARDS Biological Aspects of Thermal Pollution, II.	Water for Industrial Development in Copiah
Hydrologic Reconnaissance of Big and Little		and Simpson Counties, Mississippi,
Soda Lakes, Churchill County, Nevada,	Scientific Basis for Water Temperature Stan-	W73-02651 3E
W73-03137 7C	dards at Power Plants, W73-02766 5C	W 75-02031
	W/3-02/66 SC	Technology Transfer in Water Research-The
Fraunhofer Line-Depth Sensing Applied to	The Codorus Creek Wastewater Management	Interface Between Producers and Users.
Water,	Study, Summary Report and Conclusions.	W73-02877 6B
W73-03140 5A	W73-02869 5G	
Annual Committees and Analysis of Hudrales	1175-02005	The Importance of a Practical Research Input
Annual Compilation and Analysis of Hydrolog- ic Data for Urban Studies in the San Antonio.	Codorus Creek Water Quality Investigation Re-	to Water Resources Development,
	port,	W73-02878 6B
Texas Metropolitan Area, 1970, W73-03148	W73-02870 5G	m = 4 4m - 5 10 - 10 - 1
W73-03148 7C	WARRANCE STREET, STREE	The Transfer of Water Research Output by the
Maximum Concentration of Dissolved solids in	Quality of the Water Used for Human Con-	Environmental Protection Agency,
Surface Water, Hartford North Quadrangle,	sumption (In French),	W73-02879 6B
Connecticut.	,W73-03204 5G	Aggregate Returns from Water Resource
W73-03155 7C	WARREN ON A SERVICE BALL WARREN	Development in Georgia, 1946 -1965.
# 15-03133 /C	WATER QUAMUNICIPAL WASTES	W73-02919 6B
Biologic Parameters in Water Transmission of	Chemical and Bacteriological Quality of Water	W 13-02515
Viruses.	at Selected Sites in the San Antonio Area, Tex-	Water for Texas.
W73-03173 5A	as, August 1968-April 1972,	W73-03066 5B
#15-05115 JA	W73-02808 5B	17702000
Detection of Viruses in Water: A Review of	WATER QUANTITY	The Impact of Water Development on the
Methods and Application.	Multireservoir Analysis Techniques in Water	Ecology of Bays and Estuaries,
W73-03174 5A		W73-03069 5B
Water Same Committee Commi	Quantity Studies, W73-02664 4A	regard to bridge agents by change is a Co
Progress in the Development of an Apparatus	W /3-02004 4A	The Impact of Water Development on Ecology
for Concentration of Viruses From Large	Integrated Management of Quantity and Quali-	of the Gulf of Mexico,
Volumes of Water,	ty of Urban Water Resources,	W73-03070 5B
W73-03175 5A	W73-02666 5G	Development of Water Becomes of a Barin
and the same of th	1175 02000	Development of Water Resources of a Basin
Group Analysis of Impurities in Recalimed	WATER RESOURCES	Taking Economic Aspects into Account: Pecu-
Water (In Russian),	A Six-Year Review.	liarities of Investigation of Practical Irrigation

Major Importance to New Mexico, W73-02876 5C	A Discussion, W73-03224 5G	Water Resources on the Basis of Mathematical Modelling, W73-03227
Mathematical Models for Regional Economic	The Miami Conservancy District Experience in	#13-03221
and Waste Load Projection,	the Systems Approach to Water Quality Im-	Optimization of Basin Water Resources Utiliza-
W73-02920 5B	provement,	tion,
78 1 60 18 96	W73-03225 5G	W73-03228 4A
Compilation of Water Quality Data and	STATES AND A TABLE STANK	
Parameters from Kansas Rivers and Streams,	Programming Model of Regional Water Quality	Optimum Use of Water Resources of Basins in
W73-02973 5A	Management,	Irrigation,
	W73-03240 5G	W73-03229 3F
Health Related Problems in Arid Lands.		A STATE OF THE PARTY OF THE PAR
W73-03126 5F	Benefits of Flow Augmentation for Water	WATER RESOURCES DEVELOPMENT
	Quality Control,	Annual Report of Activities During Fiscal Year
Municipal and Industrial Waste with Limited	W73-03242 5G	1972.
Water Resources,	Sport proof in the first	W73-02630 9A
W73-03127 5F	A Branch-And-Bound Algorithm for Regional	
	Water Quality Management,	Water Research at the University of Connec-
Agricultural Wastes in Arid Zones,	W73-03243 5G	ticut.
W73-03128 5F	WATER ONAT THE OFFICE AND A PINC	W73-02631 9A
	WATER QUALITY STANDARDS	Water for Industrial Development in Copiah
Hydrologic Reconnaissance of Big and Little	Biological Aspects of Thermal Pollution, II.	and Simpson Counties, Mississippi,
Soda Lakes, Churchill County, Nevada,	Scientific Basis for Water Temperature Stan-	W73-02651 3E
W73-03137 7C	dards at Power Plants,	W/3-02631 3E
	W73-02766 5C	Technology Transfer in Water Research-The
Fraunhofer Line-Depth Sensing Applied to		Interface Between Producers and Users.
Water,	The Codorus Creek Wastewater Management	W73-02877 6B
W73-03140 5A	Study, Summary Report and Conclusions.	W /3-028//
Algorithm as a figure and a second	W73-02869 5G	The Importance of a Practical Research Input
Annual Compilation and Analysis of Hydrolog-		to Water Resources Development,
ic Data for Urban Studies in the San Antonio,	Codorus Creek Water Quality Investigation Re-	W73-02878 6B
Texas Metropolitan Area, 1970,	port,	W 13-02818
W73-03148 7C	W73-02870 5G	The Transfer of Water Research Output by the
70	Ownline of the Water Hand for Human Con	Environmental Protection Agency,
Maximum Concentration of Dissolved solids in	Quality of the Water Used for Human Con-	W73-02879 6B
Surface Water, Hartford North Quadrangle,	sumption (In French),	W 13-02019
Connecticut.	,W73-03204 5G	Aggregate Returns from Water Resource
W73-03155 7C	WATER QUAMUNICIPAL WASTES	Development in Georgia, 1946 -1965,
117-03133		W73-02919 6B
Biologic Parameters in Water Transmission of	Chemical and Bacteriological Quality of Water	W 13-02515
Viruses,	at Selected Sites in the San Antonio Area, Tex-	Water for Texas.
W73-03173 5A	as, August 1968-April 1972,	W73-03066 5B
W15-03113	W73-02808 5B	
Detection of Viruses in Water: A Review of	WARRING COLLANDS	The Impact of Water Development on the
Methods and Application,	WATER QUANTITY	Ecology of Bays and Estuaries,
W73-03174 5A	Multireservoir Analysis Techniques in Water	W73-03069 5B
W 15-03114 3A	Quantity Studies,	
Progress in the Development of an Apparatus	W73-02664 4A	The Impact of Water Development on Ecology
for Concentration of Viruses From Large	7	of the Gulf of Mexico,
Volumes of Water,	Integrated Management of Quantity and Quali-	W73-03070 5B
W73-03175 5A	ty of Urban Water Resources,	
W73-03175 5A	W73-02666 5G	Development of Water Resources of a Basin
Group Analysis of Impurities in Recalimed	W. WEB BROADBORD	Taking Economic Aspects into Account: Pecu-
	WATER RESOURCES	liarities of Investigation of Practical Irrigation
Water (In Russian), W73-03246 5A	A Six-Year Review.	Problems,
W73-03246 5A	W73-02655 9A	W73-03226 3F
WATER QUALITY CONTROL	Water Resources of the Minnesota River	regard for highly arranged to the company of the co
Improving Water Quality by Removal of Pesti-	Hawk Creek Watershed, Southwestern Min-	Some Characteristics and Applications of
	nesota.	Mathematical Programming Models in Water
cide Pollutants with Aquatic Plants,		Resource Systems,
W73-02621 5G	W73-02663 7C	W73-03232 6A
Annual Report of Activities During Fiscal Year	Water Resources of the Uspenskiy Mining Dis-	
	trict and a Technical and Economic Justifica-	Application of Hydrologic Simulation to Water
1972.		Resources Planning,
W73-02630 9A	tion of Their Use (Vodnyye resursy Uspen- skogo rudnogo poyasa i tekhniko-	W73-03236 6A
A Computer Program for Calculating Nutrient		Market and A. Market and Alabata Market Market
Balances.	ekonomicheskoye obosnovaniye ikh ispol'-	Mathematical Models and their Use in Water
	zovaniya),	Resources Decision-Making,
W73-02858 7C	W73-02814 4B	W73-03237 6A
Systems Analysis and Water Quality Manage-	Global Hydrology,	WATER RESOURCES INSTITUTE
ment.	W73-03057 2A	Annual Report FY 1972.
W72 02042 5C	W 13-03031	W73-02628 9A
W73-02943	Perspectives and Goals for Water Resource	W 13-02020 9A
Systems Approach to Problems of Water Pollu-	Planning,	Annual Report of Activities During Fiscal Year
tion Control,	W73-03182 6B	1972.
W73-03222 5G	117-03102 03	W73-02630 9A
W 13-03222 30	The Miami Conservancy District Experience in	11 13 02000 9A
Systems Approaches to Microscale Problems	the Systems Approach to Water Quality Im-	Water Research at the University of Connec-
of Water Pollution Control,	provement,	ticut.
W73-03223 5G	W73-03225 5G	W73-02631 9A
11 10 00000		

Develops the Oran 1963-71, W73-031

Location North Q W73-031

WATERSI Erosion An App W73-02

WATERS The Co Study, W73-02

Econor ty in Si W73-02 WATERS Econo ty in S W73-0

WATER Applie Mode W73-0

Force W73-4 WAVES Eddy

in Int W73-WAVE The Mod W73

Way Flui W73

For W7

Hyd Hor W7

WEAA IMM AN WEAR HH WW

WATER RESOURCES INSTITUTE

A Six-Year Review. W73-02655 9A	Public Water Supply Districts: Evaluation of a New Institution.	The Antibacterial Capabilities of Polyhalogenated Ion Exchange Resins.
Control of the Contro	W73-02918 6E	W73-03187
'Apollo County Park', Waste Water Reclama-	Contains Assessed to Designal Water War and	
tion Project for the Antelope Valley Area, Los	Systems Approach to Regional Water Use and Demand,	The Use of Quaternary Ammonium Resin- Triiodide Complex to Inactivate Virus and
Angeles County.	W73-03238 6A	Selected Bacteria,
W73-02867 5D	WATER SUPPLY DISTRICTS	W73-03188 5F
WATER REUSE	Public Water Supply Districts: Evaluation of a	WATER TYPES
Public Attitudes Toward Reuse of Reclaimed Water,	New Institution,	Mineral Waters Along the Eastern Edge of the
W73-02601 5D	W73-02918 6E	Caspian Lowland (Mineral'nyye vody
Discussion of Wasta Disposal in Asid Lands	WATER TEMPERATURE	vostochnoy okrainy Prikaspiyskoy vpadiny), W73-02813
Discussion of Waste Disposal in Arid Lands, W73-03129	Biological Aspects of Thermal Pollution, II.	W 73-02013
	Scientific Basis for Water Temperature Stan-	WATER USERS
Group Analysis of Impurities in Recalimed Water (In Russian),	dards at Power Plants, W73-02766 5C	Modern Water Rates, Part II, Meter Water in Gallons.
W73-03246 5A	The divine of the second	W73_02938 6C
VATER RIGHTS	Biological Effects of Cooling Water Discharge, W73-02772 5C	CHAIN MAK ALL POR A DECIMARING A
Adjudication Provisions Under the 1909 Water	MUNICIPAL STANDARD STANDER	WATER UTILIZATION Water Resources of the Uspenskiy Mining Dis-
Code-Survey of Case Law and Proposals for	Temperature Effects in High-Transport, Flat-	trict and a Technical and Economic Justifica-
Legislative Amendment, W73-02894 6E	Bed Flows, W73-02789 2J	tion of Their Use (Vodnyye resursy Uspen-
THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TW	ALT TOWN	skogo rudnogo poyasa i tekhniko-
WATER SHORTAGE Water for Southern Nevada,	Palacotemperature and Cohesion in Globigerina	ekonomicheskoye obosnovaniye ikh ispol'- zovaniya),
W73-02848 6D	Ooze Sediment Cores From the Caribbean Sea, W73-02797	W73-02814 4B
VATER STORAGE	CASA PROPERTY CONTRACT	Supplied Theorems of the contract Man-
Evaluation of Potable Water Storage Tanks,	A Survey of Some Possible Effects of Logging on Two Eastern Vancouver Island Streams,	Water for Southern Nevada, W73-02848 6D
W73-02656 5G	W73-03160 4C	Windows Area 1970
WATER SUPPLY	DESCRIPTION OF THE PARTY OF THE	Modern Water Rates, Part II, Meter Water in
A Water Supply-Demand Analysis in Clinton	WATER TREATMENT The Preparation and Oxidative Properties of	Gallons. W73-02938 6C
County, Pennsylvania: A Study in Economic Hydrology,	Ferrate Ion (FeO42-). Studies Directed Toward	Volume October 15 and created a state of
W73-02610 6D	Its Use as a Water Purifying Agent,	Global Hydrology,
	W73-02608	W73-03057
The Availability of Ground Water in New Cas- tle County, Delaware,	Water-Treatment-Plant Waste DisposalAction	Organizational Alternatives in Consolidating Ir-
W73-02785 4B	Now, W73-02964 5F	rigation Systems,
Water for a Rapidly Growing Urban Communi-	W73-02964 5F	W73-03107
ty-Oakland County, Michigan,	Precoat Vacuum Filtration and Natural-Freeze	Systems Approach to Regional Water Use and
W73-02804 3D	Dewatering of Alum Sludge, W73-02965 5F	Demand,
The Availability of Ground Water in Eastern	W15-02503	W73-03238 6A
Sussex County, Delaware,	Porous Support Tubes for Reverse Osmosis,	WATER VAPOR EXCHANGE
W73-02805 4B	W73-03009	Effect of Several Transpiration Suppressants
The Availability of Ground Water in Kent	An Epidemiological Study of the Effect of	on Carbon Dioxide and Water Vapor Exchange of Citrus and Grapevine Leaves,
County, Delaware, With Special Reference to	Fluorides in Drinking Water on the Frequency	W73-03192 2D
the Dover Area, W73-02806 4B	of Slipped Capital Femoral Epiphysis, W73-03071 5F	Choop Analyse of Impurities in Established
	2/10/8/2/20	WATER WELLS Geology and Ground Water of the Pajaro Val-
Occurrence of Groundwater in the Piedmont Alluvial Plain on the Northern Slope of Dzun-	Health Related Problems in Arid Lands. W73-03126 SF	ley Area, Santa Cruz and Monterey Counties,
garian Ala Tau (Formirovaniye podzemnykh	W73-03126 5F	California,
vod predgornogo shleyfa severnogo sklona Dz-	Biologic Parameters in Water Transmission of	W73-02653
hungarskogo Alatau), W73-02816 4B	Viruses, W73-03173 5A	The Availability of Ground Water in New Cas-
	with an order of the result of the surprise of solicity	tle County, Delaware,
Groundwater of the Akdala River Valley and Prospects of its Use as a Water-Supply Source	Detection of Viruses in Water: A Review of	W73-02785 4B
(Podzemnyye vody doliny r. Akdala i perspek-	Methods and Application, W73-03174 5A	Specific Capacities of Wells in Crystalline
tivy ikh ispol'zovaniya dlya vodosnabzheniya),		Rocks,
W73-02817 4B	Progress in the Development of an Apparatus	W73-02800 4B
Water for Southern Nevada,	for Concentration of Viruses From Large Volumes of Water.	The Availability of Ground Water in Eastern
W73-02848 6D	W73-03175 5A	Sussex County, Delaware,
Desalting as a Source of Water Supply,	Concentration of Viruses by Osmotic Ultrafil-	W73-02805 4B
W73-02861 3A	tration: A Preliminary Report on the Develop-	The Availability of Ground Water in Kent
Thurston County, A Comprehensive Water and	ment of a Model System,	County, Delaware, With Special Reference to
Sewerage Plan, Volume II, Water Plan.	W73-03176	the Dover Area, W73-02806
W73-02865 6D	Laboratory Studies on the Survival of	OCCUPATION OF THE PROPERTY OF
Water Requirements of Santa Barbara County,	Poliovirus in Algal-Bacterial Wastewater Treat-	Ground-Water Resources and Geology of Cook
1967 to 1990, W73-02868 6D	ment Systems, W73-03178 5D	County, Georgia, W73-02807
00	HONOLOGICAL COLONIA CO	W /3-0280/

Development of Ground-Water Resources in	WEED CONTROL	WYOMING
the Orange County Area, Texas and Louisiana,	Germination Behaviour of a Weed and Three	Shallow Aquifers Relative to Surface Waters,
1963-71, W73-03139 4B	Related Crop Plants Under Various Conditions	North Platte River Valley, Goshen County, Wyoming.
W/3-03139 4B	of Soil Water Content and Temperature, W73-02673 3F	W73-02900 4B
Location of Wells and Test Holes, Hartford	W 75-02075	
North Quadrangle, Connecticut,	Morphological Response of Two Mesquite	Ecology of Yellowstone Thermal Effluent
W73-03153 7C	Varieties to 2,4,5-T and Picloram,	Systems: Net Primary Production and Species
WATERSHED DISTURBANCE	W73-03080 4A	Diversity of a Successional Blue-Green Algal Mat.
Erosional Consequences of Timber Harvesting:	WEIRS	W73-02980 5C
An Appraisal,	Brink Depth for Trapezoidal Broad-Crested	
W73-02957 2J	Weir.	A Self-Verifying Hybrid Computer Model of
	W73-02788 8B	River-Basin Hydrology, W73-03183
WATERSHED MANAGEMENT	A TARREST TO SECOND STATE OF THE SECOND STATE	W 75-03163
The Codorus Creek Wastewater Management Study, Summary Report and Conclusions.	Aeration of Weirs,	XYLITOL
W73-02869 5G	W73-03142 8B	Experimental Substantiation of the Maximal
1175 4245	On the Optimization of the Design of Storage	Permissible Content of Pentaerythritol and
Economic Efficiency Vs. Environmental Quali-	Areas at River Dams,	Xylitol in Water Bodies, (In Russian), W73-03159 5G
ty in Small Watershed Development,	W73-03239 4A	W 73-03139
W73-02936 4D	***	YAVAN VALLEY
WATERSHEDS (BASIN)	WELFARE (ECONOMICS)	Hydrophysical Characteristics of Typical
Economic Efficiency Vs. Environmental Quali-	A New Theory of Pricing and Decision-Making	Sierozem in the Yavan Valley (In Russian),
ty in Small Watershed Development,	for Public Investment,	W73-03212 2G
W73-02936 4D	W73-02917 6B	YELLOW PERCH
	WEST PAKISTAN	The Yellow Perch Fisheries of Deer Creek
WATERSHEDS (BASINS)	Nimbus 3 and 4 Observations of Snow Cover	Reservoir, Utah, with Notes on Parasitism by
Application of a Digital Hydrologic Simulation	and Other Hydrological Features in the	Ligula Intestinalis,
Model to an Urbanized Watershed, W73-02946 2A	Western Himalayas,	W73-02701 81
W 73-02940 2A	W73-03134 7B	Culture of the Yellow Perch in the Laboratory,
WAVE FORCES		W73-02952 5G
Forces on a Submerged Breakwater,	WEST VIRGINIA	
W73-03031 8B	Comprehensive Survey of Elk River Basin,	YELLOWSTONE NATIONAL PARK
MYCHES PLEASANCE AND DESCRIPTION OF STREET	Volume II, Economic Base Study,	Ecology of Yellowstone Thermal Effluent
WAVES	W73-02860 6D	Systems: Net Primary Production and Species Diversity of a Successional Blue-Green Algai
Eddy Diffusion Coefficients due to Instabilities	Antibodies Against Human Enteric Bacteria in	Mat.
in Internal Gravity Waves, W73-02776 2E	Brown Bullheads (Ictalurus Nebulosus,	W73-02980 50
W 73-02776 ZE	Leseuer) from Contaminated Waters,	
WAVES (WATER)	W73-02975 5C	YUGOSLAVIA
The Decay and Stability of Internal Wave	Later Service Later Later Service Later Serv	Contribution to the Study of the Possibilities of
Modes in a Multisheeted Thermocline,	WET AIR OXIDATION	Introducing Pyrethrum Cinerariaefolium Trev
W73-02759 5G	Wet Oxidation of Nylon 6,6 by the Rotating	In Servia and Voyvodina: Second Report, W73-02671
Way Indust Danidam Lauren in a Startified	Disk Technique, W73-03186 5D	W 13-02011
Wave-Induced Boundary Layers in a Stratified Fluid.	# 75-05180 SD	Contribution to the Study of the Possibilities of
W73-02761 8B	WHITE MICE (MUS MUSCULUS)	Introducing Dalmatian Pyrethrum (Pyrethrum
	Bioassays of Quality in Water Resources of	Cinerariaefolium Trev.) In Serbia and
Forces on a Submerged Breakwater,	Major Importance to New Mexico,	Voyvodina: 3rd Report. The Influence of
W73-03031 8B	W73-02876 5C	Growing Site on the Percentage of Pyrethrine s W73-02672
	473.600	W 13-02012
Hydrodynamic Wave Uplift Forces on	WINKLES	ZAMBIAN SOILS
Horizontal Slabs, W73-03034 8B	The Influence of Thermal Acclimation on the	Available Water Capacities of Zambian Soils in
W 73-03034 8B	Relation Between Oxygen Consumption and	Relation to Pressure Plate Measurements and
WEATHER DATA	Temperature in Littorina littorea (L.) and Myti- lus edulis L.,	Particle Size Analysis, W73-03065
Spatial Variation of Rainfall Spectra in South	W73-02760 5C	W73-03065 20
Africa,	30	ZINC
W73-03100 2B	WISCONSIN	A Study on the Chemical Behavior of Zinc is
WEATHER MODIFICATION	Specific Capacities of Wells in Crystalline	Chesapeake Bay Water Using Anodic Stripping
WEATHER MODIFICATION Impact of Snowpack Management on Snow-	Rocks,	Voltammetry,
And-Ice Hydrology,	W73-02800 4B	W73-02783
W73-02851 3B	MUNICIPAL WAT	Manganese, Zinc and Copper Content in Or
	WITHDRAWAL Shallow Aquifers Relative to Surface Waters,	gans and Tissues of Carp Underyearlings, (In
Performance of an Atmospheric Water	North Platte River Valley, Goshen County,	Russian),
Resources Research Program in the Hungry	Wyoming,	W73-02884 51
Horse Area, Montana.	W73-02900 4B	Environmental Genchamistar in House
W73-03143 3B	10	Environmental Geochemistry in Health and Disease.
Project Foggy Cloud III, Phase 1,	WOOD SPECIES	W73-03196 51
W73-03145 3B	Investigations on the Development of Some Or-	
	namental Wood Species on Eroded Saline Soil	ZIZYPHUS JUJUBA D
Gromet II-Rainfall Augmentation in the Philip-	of the Mouth of Jijia-Bahlui Depression, (In	Biology of the Blooming of Zizyphus Jujub
pine Islands,	Rumanian),	Mill (In Russian),
W73-03149 3B	W73-02680 3C	W73-02676 31

proceed beart Space on Erebel Deleasing

ZONING

ZONING A Method of Comparing Forest Production Data to Agricultural Data in River Basin Planning, W73-03093 6F		Statement was Statement to the Thirteen and the Statement of the Statement
New Towns for the Southwest, W73-03125 6B	The set to suspend tempological according to the set of	
The Role of Zoobenthos in the Feeding of Bottom-Feeding Fish and the Food Supply After the Damming of the Don (In Russian), W73-02677 2L.		
ZOOPLANKTON Relations Between Biomass and Species Diversity in Marine and Freshwater Zooplankton Communities, W73-02967 5C		
ZYGOPHYLLUM COCCINEUM SEEDS Eco-Physiological Studies on Desert Plants. III. Respiration of Negatively Photoblastic Zygophyllum coccineum L. Seeds During Germination, W73-03116 2I		
	Victorian Control Community of Miles Community	WORLD STATE

W73-0 Role of La podde W73-0

ABELEV, Investiga Forces I Flow (Tv W73-030 ABRAMO' Number Producti W73-031 AGAMAL Reprodu Kura B tions, (I W73-02 AITCIN, A Rapid W73-03 AKAL, T. The Re ties of tom Re W73-02 AKHME Monito mont rezhim ravnin

December of Occupations

community of the state of the s

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County Towns and Will Good's appointment to

Groundation Econo Kazal zovan 1976 j W73-0

Methow W73-4 ALABA An A Fishe W73-

Cont of th Cone W73

Waterigal W73 ALLO The Syst

Syn Pro W7

ABELEV, A. S. Investigation of Nonstationary Hydrodynamic	ANCELLIN, J. Uptake of Rul06 by Marine Organisms in	BAGLIN, R. E. JR Surface Phytoplankton and Some Aspects of
Forces Induced by a Plate Oscillating in Liquid Flow (Two-Dimensional Problem),	Aquaria and in the Natural Environment (Ob- servations Concernant les Contaminations Ex-	the Physical-Chemical Limnology of Three Areas on Lake Texoma,
W73-03050 8B	perimentales et les Contaminations 'In situ' D'especes Marines Par Le Ru106,	W73-03072 2H
ABRAMOVA, L. P. Number of Commercial Fish in the Volgograd	W73-02717 5B	BAGNIS, R. Study of the Pollution of the Lagoon at Tahiti
Reservoir and Measures for Increasing Their	ANDERSON, A.	by Fecal Germs (In French),
Productivity, (In Russian), W73-03172	Net A Profit From Farm Fish Crop,	W73-03181 5B
	W73-02924 3E	BAKER, D. R.
AGAMALIEV, A. S. Reproduction of the Caspian Lamprey in the	ANDERSON, J. R.	Remote Sensing of Snow Fields from Earth Satellites.
Kura Basin Under Hydroconstruction Condi-	A Land-Use Classification System for Use With Remote-Sensor Data,	W73-03133 7B
tions, (In Russian), W73-02684 5C	W73-02649 7B	BAKER, G. E.
AITCIN, P. C.	ANDERSON, J. U.	An Ecological Study of the Soil Microfungi in a Hawaiian Mangrove Swamp,
A Rapid Grain Size Analysis Method,	Soil Associations and Land Classification for	W73-03205 2I
W73-03249 8D	Irrigation, Lincoln County, W73-02623 3F	BAKKER, J. H.
AKAL, T.		Electrical Energy, Demand and Supply,
The Relationship Between the Physical Proper- ties of Underwater Sediments That Affect Bot-	ANDERSON, K. D. Environmental Radioactivity Measurement Ex-	W73-02769 5C
tom Reflection,	perience Near a Fuels Reprocessing Plant,	BAKOV, YE. K.
W73-02798 2J	W73-02741 5B	Dynamics and Structure of the Yuzhnyy In- yl'chek Glacier (Voprosy dinamiki i struktury
AKHMEDSAFIN, U. M.	ANDERSON, R. G.	lednika Yuzhnyy Inyl'chek),
Monitoring Groundwater Reservoirs in Pied- mont Plains of Tien Shan (Upravleniye	The Containment and Recovery of Navy Oil	W73-02639 2C
rezhimom podzemnykh vod na predgornykh	SpillsA Financial Analysis, W73-02909 5G	Mechanism of the Formation of Some 'Ter-
ravninakh Tyan' -Shanya), W73-02815 4B		minal Moraines' and Role of Water in Glacial Erosion (Mekhanizm obrazovaniya nekotorykh
SOUTH AND A LOCAL PROPERTY.	ANDRIYENKO, T. L. Modes of Bog Development in the Ukrainian	'konechnykh moren' i rol' vodnoy erozii v
Role of Groundwater in Maintaining the Level of Lake Balkhash (Rol' podzemnykh vod v	Carpathians (In Russian),	dinamike lednika), W73-02642 2C
podderzhanii urovnya oz. Balkhash),	W73-02693 4A	
W73-02811 4B	AOKI, T.	Morphology of Glacial Lake Merzbacher and Mechanics of its Catastrophic Outburst (Mor-
AKHMHEDSAFIN, U. M.	Fouling: The Major Unresolved Problem in Heat Transfer.	fologiya lednikovogo ozera Mertsbakhera i
Groundwaters of Kazakhstan and Recommen- dations Regarding Their Use in the National	W73-02775 8B	mekhanizm yego katastroficheskikh proryvov), W73-02640 2C
Economy for 1976-80 (Podzemnyye vody Kazakhstana i rekomendatsii po ikh ispol'-	ARMSTRONG, W.	Rate of Movement, Ablation, and Dynamics of
zovaniyu v narodnom khozyaystve v period s	Radial Oxygen Losses from Intact Rice Roots	Some Glaciers of the Ak-Shiyrak Range
1976 po 1980 g.), W73-02810 4B	as Affected by Distance from the Apex, Respiration and Waterlogging,	(Skorostnoy rezhim, tayaniye i dinamika neko- torykh lednikov massiva Ak-Shiyrak),
Application of the same of the	W73-02930 3F	W73-02637 2C
AKIN, E. W. Detection of Viruses in Water: A Review of	ARVANITIDIS, N. V.	BAKSHEEVA, I. P.
Methods and Application,	A Computer Simulation Model for Flood Plain	Radioactivity of Waters in Northeastern Part of
W73-03174 5A	Development, Part 1: Land Use Planning and Benefit Evaluation,	Atlantic Ocean, W73-02710 5B
ALABASTER, J. S.	W73-02944 4A	BALOCH, M. S.
An Approach to the Problem of Pollution and Fisheries.	ASTAFUROVA, A. A.	Comprehensive Survey of Elk River Basin,
W73-03163 5C	Determination of Optimal Proportions of	Volume II, Economic Base Study, W73-02860 6D
ALBINET, E.	Nitrogen and Phosphorus Contents Used for Pond Fertilization, (In Russian),	
Contribution to the Knowledge of the Growth	W73-02681 8I	BANIN, A. Transfer Properties and Friction Coefficients
of the Maize Root System Under Irrigation Conditions,	AUSTIN, C. B.	for Salt and Water Flow Through Clays,
W73-02668 3F	An Economic Inventory of the Miami River	W73-02829 2G
Dynamics of Nitric and Ammonia Nitrogen Ac-	and Its Economic and Environmental Role in Biscayne Bay,	BANSE, K.
cumulation in the Soil, in the Interval Between Watering in the Case of Sprinkling and Bed Ir-	W73-02923 4A	Some Species of Phyllodocidae, Syllidae, Nephtyidae, Goniadidae, Apistobranchidae and
rigation of Maize,	AYRAPET'YANTS, S. E.	Spionidae (Polychaeta) from the Northeast
W73-02669 3C	Dynamics and Structure of the Yuzhnyy In-	Pacific Ocean, W73-03221 5B
ALLOTT, D. J.	yl'chek Glacier (Voprosy dinamiki i struktury lednika Yuzhnyy Inyl'chek),	BARDEN, L.
The Response of Gooseberries to Non-Tillage Systems of Management,	W73-02639 2C	The Flow of Air and Water in Partly Saturated
W73-02699 3F	Morphology of Glacial Lake Merzbacher and	Clay Soil,
AMAVIS, R. J.	Mechanics of its Catastrophic Outburst (Mor-	
Symposium on Radioecology Applied to the	fologiya lednikovogo ozera Mertsbakhera i mekhanizm yego katastroficheskikh proryvov),	BARRY, R. F. Toxicity and Spreading of Oil in Sea Water,
Protection of Man and His Environment, W73-02722 5B	W73-02640 2C	W73-02903 SG

BARTHET, H. Loss of Pressure Due to Periodic Movement of	BENDER, D. L. Flood Hydrographs for Ungaged Streams,	BLATNENE, D. P. Growth Characteristics, Structure and
an Obstacle (Sur la perte de charge due a un obstacle en mouvement periodique), W73-03020 8B	W73-02880 2E BENNETT, R. H.	Abundance of Abramis Brama (L.) In the Water Passages of the Summer Diked Marshes of the Nyamunus Delta (In Russian),
	Palaeotemperature and Cohesion in Globigerina	W73-02678
BASCO, D. R. Optimized Geometry for Baffle Blocks in Hydraulic Jumps,	Ooze Sediment Cores From the Caribbean Sea, W73-02797 2J	BLEIWEIS, J. Forces Exerted on Small Structures by a Fluid
W73-03036 8B	BENTON, W. H.	with a Free Surface in Alternating Movement
BASKAKOVA, A. G. Concerning Velocity Distributions in Turbulent	Detection of Viruses in Water: A Review of Methods and Application,	(efforts exerces par un fluide a surface libre en mouvement alternatif sur des structures fines),
Flow at Porous Surfaces,	W73-03174 5A	- A A TELEASOLUTIO
W73-03059 8B	BERGT, K. 1442 multastiberatio patishmal A	BOEGLY, W. J. JR
BACCOUTT B	Investigations into the Formation of Biogenetic	Effect of Brine Disposal Cost on Hyperfiltra-
BASSETT, B. Mercury Pollution of Golf Course Lakes,	Vertical Tubes in the Subsoil of Diked Marshes	tion Plant Optimization,
W73-02615 SB	in Schleswig-Holstein, (In German),	W73-02914 5E
Quite I strongton conewall	W73-02687 21	ATTCSN, P. C.
BATANOUNY, K. H.	Soil Assessations and Land Climaterion for	BOEHLER, R. A.
Eco-Physiological Studies on Desert Plants. III.	BERLIN, A.	Removal of Phosphates from Sewage Effluent,
Respiration of Negatively Photoblastic	Symposium on Radioecology Applied to the	W73-03000 5D
Zygophyllum coccineum L. Seeds During Ger-	Protection of Man and His Environment,	BOHM, P.
mination,	W73-02722 5B	Pollution: Taxation or Purification,
W73-03116	BERNDT, H. D.	W73-02911 5D
BATENKO, A. I.	Sediment Yield Computed With Universal	IC
Fertilizer and Methods of Preparing the Soil in	Equation	BOLUS, R. L.
Carp Breeding Ponds, (In Russian),	W73-02794 21	Thermal Effects of the Surry Nuclear Power
W73-02749 8I	The Containment and Revieway of New Oil	Plant on the James River, Virginia; Part II:
Machanian of the Poppings of Some Tor-	BERTOLERO, L. L.	Results of Monitoring Physical Parameters of
Nitrogen Compound Regime in the Water and	Influence of Temperature on Taste Intensity	the Environment Prior to Plant Operation,
Soil of Ponds, (In Russian),	and Degree of Liking of Drinking Water,	W73-02767
W73-02756	W73-02779 5F	BONDAREV, L. G.
BATURIN, G. N.		Secular Growth of Some Tien Shan Glaciers (O
Uranium Concentration in Recent Ocean Sedi-	BHUSHAN, L. S.	poluvekovom razvitii nekotorykh Tyan'-Shan'-
ments in Zones of Rising Currents,	Influence of Shape of Implements on Soil	skikh lednikov),
W73-02748 5B	Structure, W73-03203 2G	W73-02641 2C
DATION W	n danker bereit beleit off ag	BONTAN P
BAUCH, W.	BIDARD, R.	BONHAM, K.
On the Optimization of the Design of Storage Areas at River Dams,	Centrifugal, Multieffect Distillation Apparatus,	Low Level Chronic Irradiation of Salmon. An- nual Progress Report,
W73-03239 4A	W73-02986 3A	W73-02714 5C
		York will be listerementally a smitheline it
BAUR, P. S. JR	BIGBEE, P. D.	BORGSTORM, R. E.
Effects of Salt Treatments of Cotton Plants	Pollution Studies of the Regional Ogallala	Cost Analysis of Optional Methods of Ship-
(Gossypium hirsutum L.) on Leaf Mesophyll	Aquifer at Portales, New Mexico,	board Waste Disposal,
Cell Microstructure,	W73-02891 5B	W73-02916 5E
W73-03081 3C	BINGHAM, S. W.	BORJESON, H.
BAYAZIT, M.	Improving Water Quality by Removal of Pesti-	Acidity and Lactate Content in the Blood of
Forces Due to Cylinders Falling Through Water	cide Pollutants with Aquatic Plants,	Young Atlantic Salmon (Salmo salar L.) Ex-
in a Vertical Tube,	W73-02621 5G	posed to High pCO2,
W73-03021 8B	W73.02044	W73-03170 5C
Concentrative Smith of Eth Moor Been	BISHOP, D. F.	tion million to mildret bit at Kasenga Arr
BEAR, J.	Removal of Nitrogen and Phosphorus from	BOULOT, F.
On the Flow of Two Immiscible Fluids in Frac-	Waste Waters,	Damping of Natural Vibrations of an Immersed
tured Porous Media, W73-02828 2F	W73-03002 5D	Cylindrical Shell with Free Ends: Influence of
W73-02828 2F	RISOUR R. E. 18420 FTW	Confinement of the Fluid by an Axial Shell
BECHTEL, T. J.	BISQUE, R. E. Environmental Dynamics of Mercury,	(Amortissement des vibrations propres d'une
The Impact of Water Development on the	W73.02729 SR	coque cylindrique immergee et libre a ses deux
Ecology of Bays and Estuaries,	THY BERGE IN THESE PROPERTY AND AND AND THE	extr emites: influence du confinement du fluide par une coque axiale),
W73-03069 5B	BISWAS, A. K.	
RPLIA DA	Mathematical Models and their Use in Water	W73-03052
BELLA, D. A. Environmental Planning and Ecological Possi-	Resources Decision-Making,	A Method Utilizing an Integral Formulation of
bilities,	W73-03237	Problems of Natural Vibrations of Shells in the
W72 02194	AVIOLOGY - OF THE PROPERTY AND THE VIOLENCE OF	Presence of an Incompressible Fluid (A propos
E27(8/(1/8)	BLAKEY, J. F.	d'une methode utilisant une formulation in-
BELLAN, G.	Chemical and Bacteriological Quality of Water	tegrale du probleme des vibrations propres de
Effects of an Artificial Stream on Marine Com-	at Selected Sites in the San Antonio Area, Tex-	coques en presence d'un fluide incompressi-
munities,	as, August 1968-April 1972,	ble),
W73-03171 SC	W73-02808 5B	W73-03051
BEN-SHAUL, Y.	BLASE, M. G.	Natural Vibrations of Cylindrical Shells in a
Effects of Streptomycin on the Ultrastructure	Public Water Supply Districts: Evaluation of a	Moving Fluid (Vibrations propres de coques
of Plastids in Euglena,	New Institution	cylindriques en presence de fluide),
W73-02972 5C	W73-02918 6E	W73-03048 8B

BROEN Ident Refin Effec W73-

BOVARD, P.	BROUSSARD, W. L.	CARLSON, A. R.
Uptake of Ru106 by Marine Organisms in Aquaria and in the Natural Environment (Ob-	Water Resources of the Minnesota River- Hawk Creek Watershed, Southwestern Min-	Culture of the Yellow Perch in the Laboratory, W73-02952 50
servations Concernant les Contaminations Ex- perimentales et les Contaminations 'In situ' D'especes Marines Par Le Ru106,	nesota, W73-02663 7C	CARR, W. E. S. An Ecological Approach to Marine Radiologi
W73-02717 5B	BRUCKER, R. W.	cal Monitoring At the Florida Power Corpora
BOWMAN, T. L.	Role of Vertical Shafts in the Movement of	tion Crystal River Nuclear Plant, W73-02737 SE
Analysis of the Effects on Oil Spills of Fuel	Ground Water in Carbonate Aquifers, W73-02803 2F	
Policy Changes and the Addition of Another		CARRIGAN, P. H. JR
Fuel Pier with the Aid of a Computer Simula- tion Model,	BRUGGEMAN, G. A. The Reciprocity Principle in Flow Through	Handling Hot Water, With A Payoff, W73-02780 SC
W73-02908 5G	Heterogeneous Porous Media,	1 V 200
BOYER, J. S.	W73-02827 4B	Probability of Exceeding Capacity of Flood Control System at the National Reactor Testin Station, Idaho,
Nutrient Status and Mycorrhizal Enhancement of Water Transport in Soybean,	BRUNGS, W. A. Changes in the Blood of the Brown Bullhead	W73-02781 4/
W73-03087 3F	(Ictalurus nebulosus (Lesueur)) Following	CAUSON C. I
Relationship of Plant Moisture Status to Irriga-	Short and Long Term Exposure to Copper (II), W73-02947 5C	CAUSON, G. J. A New Approach to Efficiency Guarantees,
tion Need in Corn and Soybean Crops,		W73-02842 86
W73-02604 2I	BRUVOLD, W. H.	CECEN, K.
BOZRKO, L. E.	Public Attitudes Toward Reuse of Reclaimed Water,	Forces Due to Cylinders Falling Through Water
Pepper Yield As Affected by	W73-02601 5D	in a Vertical Tube, W73-03021
Hydrometeorological Factors (In Russian), W73-02674 3F	BUCKA, H.	
	Peculiarities of the Phytoplankton Species	CHABERT D'HIERES, G.
BRACKEN, J. J. Age and Growth of Pike in Five Irish	Composition of Some Forest Ponds,	Forces Exerted on Small Structures by a Flui with a Free Surface in Alternating Movemen
Limestone Lakes,	W73-02644 21	(efforts exerces par un fluide a surface libre e
W73-02883	BUGLIARELLO, GEORGE	mouvement alternatif sur des structures fines), W73-03039
BRADFORD, W. L.	Problem-Oriented Computer Languages in Hydraulic Engineering: A Brief Overview of	
A Study on the Chemical Behavior of Zinc in	Their Evolution, State of the Art and Future,	CHAMP, W. S. T. Age and Growth of Pike in Five Iris
Chesapeake Bay Water Using Anodic Stripping Voltammetry,	W73-03245 7C	Limestone Lakes,
W73-02783 5B	BUKACH, V. I.	W73-02883
BRAESTER, C.	On the Equilibrium of a Cable Connected to a	CHAPLIN, J. R.
On the Flow of Two Immiscible Fluids in Frac-	Free-Floating Body Placed in a Stream, W73-03062 8B	Flow-Induced Dynamic Pressures on Square
tured Porous Media, W73-02828 2F		Section Cylinders, W73-03022
Control of the Contro	BURKS, S. L. Identification of Toxic Components in Oil	
BRANION, R. M. R. Oxygen Transfer to Water and to Sodium	Refinery Effluents and Determination of Their	CHAPOVSKAYA, E. V. Hydrophysical Characteristics of Typics
Sulfite Solutions,	Effect Upon the Aquatic Biota,	Sierozem in the Yavan Valley (In Russian),
W73-02962 5G	W73-02609 5A	W73-03212
BRANSON, F. A.	BURRELL, D. C.	CHEN, T. C.
Vegetation, Runoff, and Sediment Yield Rela-	Trace-Metal Associations in Sub-Artic and Arc- tic Marine Environments - Progress Report,	Improved River Basin Utilization Throug
tionships, W73-03067 5B	June 1971-May 1972,	Systems Analysis, W73-02665 6
	W73-02754 5B	
BRASTER, R. E. Mathematical Models for Regional Economic	BYERS, D.	CHEONG, H. F. Dispersion of Contaminated Bed-Load Part
and Waste Load Projection,	Economic Efficiency Vs. Environmental Quali-	cles,
W73-02920 5B	ty in Small Watershed Development, W73-02936 4D	W73-02650
BRAVDO, BEN-AMI		CHERBAR', V. V.
Effect of Several Transpiration Suppressants	CAIRNS, J. JR Application of Biological Monitoring Systems	Comparative Characteristics of Old-Irrigate
on Carbon Dioxide and Water Vapor Exchange of Citrus and Grapevine Leaves,	to Simulated Industrial Waste Discharge Situa-	Sicrozems in the Vakhsh Valley with Com- pacted and Uncompacted Subarable Horizon
W73-03192 2D	tions,	(In Russian),
BRIGHAM, A. R.	W73-02617 5C	W73-03215
Assimilation of a Wastewater Treatment Plant	CALIFF, J. M. JR	CHERDYNTSEV, V. V.
Effluent by the Asa Creek-Kaskaskia River	An Approach for Involving Local Officials and Citizens in Regional Water Quality Studies,	Origin of Manganese Nodules of the Pacifi Ocean From Radioisotope Data,
System, Moultrie County, Illinois, W73-02887 5C	W73-02956 5G	W73-62752 5
	CARDENAS, R.	CHERTKO, N. K.
Physico-Chemical Limnology and Periphyton in a Warm-Water Stream Receiving Wastewater	Effects of Salt Treatments of Cotton Plants	Soil Complexes in the East of the Bres
Treatment Plant Effluent,	(Gossypium hirsutum L.) on Leaf Mesophyll	Polesie, (In Russian),
W73-02603 5D	Cell Microstructure, W73-03081 3C	W73-03006 2
BROEMELING, L. D.		CHHONKAR, P. K.
Identification of Toxic Components in Oil Refinery Effluents and Determination of Their	CARFAGNO, D. G. Environmental Monitoring Report: July-	Seed Pelleting in Relation to Nodulation an Nitrogen Fixation by Phaseolus aureus L. in
Effect Upon the Aquatic Biota,	December 1971 and 1971 Summary,	Saline Alkali Soil,
W73-02609 5A	W73-02709 5B	W73-03097

DEMOYER, B An Experie visory Cont W73-02871 DEMPSTER, Annual Cor ic Data for Metropolita W73-02652 DENIKE, E. Petroleum | W73-02866 DENN, M. M. Rotational tions, W73-02874 DEUL, M. Limestone Waters, W73-02994 DICK-PEDD A Land-U DICK, R. I. Mechanisa W73-0294 DICK, T. M. Forces on W73-0303 DIKEOU, J. Concrete-Report, W73-0284 DIKIKH, A Ablation nika Sem W73-0263 Heat Bal face Du balans p period ta W73-026 Mass Bu Northern (Byudzh Terskey kak), W73-026 DOBRENZ Morphol W73-031 DODGE, C Cloud C Studies, W73-028 DOERKSI Columb Negotia W73-02 DOLNIK

Investig

Forces

Flow (7

W73-03

CHIA, S. N. Thermal Effects of the Surry Nuclear Power	COOLEY, P. Control of Thermal Stratification in Thames	DAGAN, G. Some Aspects of Heat and Mass Transfer in
Plant on the James River, Virginia; Part II: Results of Monitoring Physical Parameters of the Environment Prior to Plant Operation,	Valley Reservoirs, W73-02778 5B	Porous Media, W73-02823 2F
W73-02767 5C	COOPER, R. C. Laboratory Studies on the Survival of	DAL'YAN, I. B.
CHIANG, L. T. A New Approach for Water Reclamation - Complete Treatment of Waste Water by Physico-Chemical Processes,	Poliovirus in Algal-Bacterial Wastewater Treat- ment Systems, W73-03178 5D	Mineral Waters Along the Eastern Edge of the Caspian Lowland (Mineral'nyae vody vostochnoy okrainy Prikaspiyakoy vpadiny), W73-02813
W73-02607 5D	COPELAND, B. J.	DANIELS, S. L.
CHIEN, Y. T. A New Data Base for Syntax-Directed Pattern Analysis and Recognition,	The Impact of Water Development on the Ecology of Bays and Estuaries, W73-03069 5B	Removal of Phosphate from Waste Water, W73-02990 5D
W73-02885 7C	COREY, A. T.	DARDZHIMANOV, A. R. External Friction Coefficient of Sierozem (In
CHOKIN, SH. CH. Optimization of Basin Water Resources Utiliza- tion.	Boundary Effects in Desaturation of Porous Media, W73-03064 2G	Russian), W73-03213 2G
W73-03228 4A	COSSEY, H. F.	DASGUPTA, S. P.
CHOTTINER, J.	Method of Recovering Oil form an Oil Slick,	Accelerated Motion of a Sphere in an Oscillat- ing Fluid,
Porous Support Tubes for Reverse Osmosis,	W73-03007 5G	W73-03028 8B
W73-03009 3A	COUTANT, C. C.	DAVIDS, J. A. G.
CHOW, VEN TE Stochastic Analysis of Hydrologic Systems, W73-03235 2A	Biological Aspects of Thermal Pollution, II. Scientific Basis for Water Temperature Stan- dards at Power Plants,	Environmental Effects Specific to Nuclear Power Production,
	W73-02766 5C	W73-02774 5C
CHRISTENSEN, B. A. Equivalent Roughness for Shallow Channels, W73-02786 8B	CROKE, E. J. The Relationship Between Land Use and En-	DAVIDSON, K. A. A Method of Comparing Forest Production
CHRISTENSEN, G. M.	vironmental Protection,	Data to Agricultural Data in River Basin
Changes in the Blood of the Brown Bullhead	W73-02915	Planning, W73-03093 6F
(Ictalurus nebulosus (Lesueur)) Following Short and Long Term Exposure to Copper (II),	CROKE, K. G.	DAVIS, P. W.
W73-02947 5C	The Relationship Between Land Use and Environmental Protection, W73-02915 4A	Organochlorine Insecticide, Herbicide and Polychlorinated Biphenyl (PCB) Inhibition of
CHUGAEV, R. R. Mechanical Action of Non-Stationary Flow of Water on Porous Bodies and Through Struc-	CROSS, M. J.	Nakatpase in Rainbow Trout, W73-03165 5C
tures,	The Decay and Stability of Internal Wave Modes in a Multisheeted Thermocline,	DE JONG, R. L. A.
Account the contract of the second	W73-02759 5G	Experimental Investigation of Hydraulic Transients in River-Reservoir Systems, Phase
CLARK, R. S. Project Foggy Cloud III, Phase 1, W73-03145 3B	CROUZET, E. Tritium in Investigation of Surface Hydrology.	III, W73-02706 8B
CLARK, W. E.	Experimental Determination of Coefficient of Runoff,	DE JOSSELIN DE JONG, G.
Survey of the Mercury Reprocessing Industry, 1968-1970,	W73-02713 5B	The Tensor Character of the Dispersion Coeffi- cient in Anisotropic Porous Media,
W73-02931 5G	CROWE, R. E. The Transfer of Water Research Output by the	W73-02831 2G
CLARK, W. J. The Composition and Distribution of the Fish	Environmental Protection Agency, W73-02879 6B	DEFILIPPI, J. A.
Fauna of the Navasota River,	CULBERT, D. L.	Systems Approaches to Microscale Problems of Water Pollution Control,
	The Use of a Multi-Celled Apparatus for	W73-03223 5G
The Impact of Water Development on the Ecology of River Systems,	Anaerobic Studies of Flooded Root Systems, W73-03194 21	DEININGER, R. A. Systems Approach to Problems of Water Pollu-
W73-03068 5B	CURD, M. R.	tion Control,
Method of Recovering Oil form an Oil Slick, W73-03007 5G	Identification of Toxic Components in Oil Refinery Effluents and Determination of Their	W73-03222 5G DEKKER, C. L.
COLE, E. L.	Effect Upon the Aquatic Biota, W73-02609 5A	The Occurrence and Possible Source of the
Eradicating Oil Slicks, W73-02996 5G	As Approach the health white cours discounted by	Coliform Bacteria on the Shoreline of Northern
	CURL, H. JR Diel Periodicity of Chlorophyll a Concentration	Lake Michigan, W73-02606 5B
Freezing Oil Spills, W73-03013 5G	in Oregon Coastal Waters,	DELLEUR, J. W.
COLLINS, R. P.	W73-02970 5C	Some Extensions of Linear Systems Analysis
Production of Geosmin and 2-Exo-Hydroxy-2- Methylbornane by Streptomyces odorifer, W73-02949 5A	CYWIN, A. Neutralization of Ferrous Iron-Containing Acid Wastes.	in Hydrology, W73-02662 2A
	W73-02993 5D	DELUCIA, R. J.
CONNER, J. R. Risk Programming: An Aid in Planning Reservoir-Irrigation Systems,	Neutralization of Ferrous ron-Containing Acid Wastes,	Some Characteristics and Applications of Mathematical Programming Models in Water Resource Systems,
W73-03248 3F	W73-02995 5D	W73-03232 6A

DEMOYER, R. JR	DONALDSON, L. R.	EAKIN, M.
An Experiment in Computer-Assisted Super- visory Control of a Water Distribution System,	Low Level Chronic Irradiation of Salmon. An- nual Progress Report,	Adjudication Provisions Under the 1909 Water CodeSurvey of Case Law and Proposals for
W73-02871 4A	W73-02714 5C	Legislative Amendment, W73-02894 6E
DEMPSTER, G. R. JR	DORRIS, T. C.	Street Water Street Water Street and Street
Annual Compilation and Analysis of Hydrolog- ic Data for Urban Studies in the Dallas, Texas	Identification of Toxic Components in Oil Refinery Effluents and Determination of Their	EATON, F. M. Salt Injury to Plants with Special Reference to
Metropoitan Area, 1970,	Effect Upon the Aquatic Biota,	Cations Versus Anions and Ion Activities,
W73-02652 7C	W73-02609 5A	W73-03077
DENIKE, E.	DRIVER, E. E.	EDMONSTON, R. M.
Petroleum Hydrocarbons and the Sea,	Hydrodynamic Forces on Diffuser Pipes Due to Barge Passage,	Water Requirements of Santa Barbara County
W73-02866 5C	W73-03032 8B	1967 to 1990, W73-02868 6I
DENN, M. M.	DROZHZHINA, T. M.	
Rotational Stability in Dilute Polymer Solu-	Hydrophysical Characteristics of Typical	EDMUNDS, L. N. JR Persisting Circadian Oscillations in Enzyme
tions, W73-02874 2E	Sierozem in the Yavan Valley (In Russian),	Activity in Non-Dividing Cultures of Euglena,
	W73-03212 2G	W73-02969 50
DEUL, M. Limestone Neutralization of Dilute Acid Waste	DUCKSTEIN, L.	EFIMOVA, E. N.
Waters,	Data Collection for Water Systems Control, W73-03241 7C.	Herbivorous Fish in Ponds for Peat Production
W73-02994 5D	W73-03241 7C	(In Russian), W73-02718
DICK-PEDDIE, W. A.	DUENSING, W. J.	W 73-02/16
A Land-Use Plan for the Arid Southwest,	Precoat Vacuum Filtration and Natural-Freeze Dewatering of Alum Sludge,	EIKHOF, R.
W73-03120 6B	W73-02965 5F	A Hydrophilic Polymer as a Soil Amendment, W73-03098
DICK, R. I.	DUKE, H. R.	
Mechanisms of Sludge Thickening,	Boundary Effects in Desaturation of Porous	EISA, H. M.
W73-02948 5D	Media,	Morphological and Anatomical Aspects of Oedema in Eggplants (Solanum melongena L.),
DICK, T. M.	W73-03064 2G	W73-03105
Forces on a Submerged Breakwater,	DUNCAN, D. W.	Scrubbed Diesel Exhaust for Carbon Dioxid
W73-03031 8B	Oxygen Transfer to Water and to Sodium Sulfite Solutions,	Enrichment of Greenhouse Vegetables,
DIKEOU, J. T.	W73-02962 5G	W73-03074
Concrete-Polymer MaterialsFourth Topical		ELDER, R. A.
Report, W73-02845 8F	DUNCAN, J. M. Stresses and Movements in Oroville Dam,	Hydrodynamic Forces on Diffuser Pipes Du
	W73-02849 8D	to Barge Passage, W73-03032
DIKIKH, A. N. Ablation of the Semenov Glacier (Tayaniye led-	DUREN, F. K.	
nika Semenova),	Water for Southern Nevada,	Hydrodynamic Forces on Single Intake Gates,
W73-02636 '2C	W73-02848 · 6D	W73-03046
Heat Balance of the Kara-Batkak Glacier Sur-	DUTINA, O. P.	ELGHAMRY, O. A.
face During an Ablation Season (Teplovoy	Dynamics of the Poplar Forest Associations in	Hydrodynamic Wave Uplift Forces of Horizontal Slabs,
balans poverkhnosti lednika Kara-Batkak v	River Basins of the Lake Baikal Southeastern Shore, (In Russian),	W73-03034 8
period tayaniya), W73-02638 2C	W73-02881 4A	ELIZAROVA, N. S.
	DUVIGNEAUD, J.	Number of Commercial Fish in the Volgogra
Mass Budget of the Kara-Batkak Glacier on the Northern Slope of the Terskey Ala-Too Range	The Association of Littorella Uniflora and	Reservoir and Measures for Increasing The
(Byudzhet lednikov severnogo sklona khrebta	Eleocharis Acicularis in the 'Entre-Sambre-Et-	Productivity, (In Russian), W73-03172
Terskey Ala-Too na primere lednika Kara-Bat-	Meuse,' W73-02691 2I	
kak), W73-02634 · 2C		ELLENBOGEN, B. Organizational Aspects of Irrigation Systems,
	DYHR-NIELSEN, M. An Application of Multi-variate Analysis in	W73-03106
DOBRENZ, A. K.	Hydrology,	
Morphological and Anatomical Aspects of Oedema in Eggplants (Solanum melongena L:),	W73-02873 2E	ELLENDER, R. Concentration of Viruses by Osmotic Ultraf
W73-03105. 2I	DZHABASOV, M. KH.	tration: A Preliminary Report on the Develo
DODGE, C. E.	Groundwaters of Kazakhstan and Recommen-	ment of a Model System, W73-03176
Cloud Chamber Design for Water Evaporation	dations Regarding Their Use in the National Economy for 1976-80 (Podzemnyye vody	
Studies,	Kazakhstana i rekomendatsii po ikh ispol'-	ELLIOTT, S. D.
W73-02889 2B	zovaniyu v narodnom khozyaystve v period s	Gromet IIRainfall Augmentation in the Phili pine Islands,
DOERKSEN, H. R.	1976 po 1980 g.), W73-02810 4B	W73-03149
Columbia River Interstate Compact, Politics of Negotiation.		ELORANTA, P.
Negotiation, W73-02614 6E	DZUGAEV, V. V. The Impact of the Jet on the Obstacle,	On the Phytoplankton of Waters Polluted by
	W73-03037 8B	Sulphite Cellulose Factory,
DOLNIKOV, L. L. Investigation of Nonstationary Hydrodynamic	EADIE, W.	W73-02979
Forces Induced by a Plate Oscillating in Liquid	Project Fog Drops. Part 1: Investigations of	ELSHOUT, A. J.
Flow (Two-Dimensional Problem),	Warm Fog Properties, W73-02782 2B	Air Pollution from Combustion Products, W73-02771
W73-03050 8B	W73-02782 2B	11.5-00111

GALLEZ, B. Trajectory of Deviating Flu flottants dan device), W73-03035 GALLMAN, W. Soil Associat Irrigation, Lin W73-02623 GAMBLE, H. B A Comparise Water-Based W73-02612 An Ecologic cal Monitori tion Crystal W73-02737 GARDNER, L. Pediments a ley, Clark C W73-03146 An Approac Fisheries, W73-03163 GARNER, C. Catfish Pro Estimated and Returns W73-02926 GARNSEY, N New Town W73-03125 GATES, D. M Future E Southwest W73-03119 GAUSMAN, Effects of (Gossypius Cell Micro W73-03081 GAVRILA, Considera Phytoplan Complex, W73-0268 GELHAR, I Gravitatio Aquifers, W73-0279 GEMMELL Water ar Manual fe W73-0287 GENSLER, A Plast Chamber W73-0309

GERDEMA

Nutrient

of Water W73-030

5B

mas.	21	20.0	4	87	w.
SIL	O.	ALTO.	M		

ENGLEHART, R. W. An Ecological Approach to Marine Radiological Monitoring At the Florida Power Corporation Crystal River Nuclear Plant, W73-02737 5B	FEDORIN, Y. V. Soils of Piedmont Debris Cones and the Possibilities for their Agricultural Utilization (In Russian), W73-03209 2G	FRALEIGH, P. C. Ecology of Yellowstone Thermal Effluent Systems: Net Primary Production and Species Diversity of a Successional Blue-Green Algal Mat,
10 to	COOPER E.C	W73-02980 5C
EPSTEIN, E. Calcium and Salt Toleration by Bean Plants, W73-03094 3C	FELTON, M. JR Virus-Sized Particle Adsorption on Soil-Part I: Rate of Adsorption, W73-03177 5B	FRANKE, P. G. Amplitude-Dependent Frequency of An Oscillating Cylinder in a High-Velocity Flow,
ERCHUL, R. A.		W73-03026 8B
The Use of Electrical Resistivity to Determine Porosity of Marine Sediments, W73-03141	FEVAL, G. Study of the Pollution of the Lagoon at Tahiti by Fecal Germs (In French), W73-03181 5B	FREEMAN, R. A. Toxicity of Aluminum Hydroxide Complexes in Neutral and Basic Media to Rainbow Trout, W73-02951 SC
ERKKENOVA, E. M.	FILATOV, V. L. M.T. AMBERTATORY	# 75-02551
Biology of the Blooming of Zizyphus Jujuba Mill (In Russian), W73-02676	Daily Rations and Nutritive Coefficients of Carp Larvae Fed on Brachionus Calyciflorus	PREUND, R. J. Risk Programming: An Aid in Planning Reser-
W.12-02010	(Pallas), (In Russian),	voir-Irrigation Systems,
ERSOZ, A.	W73-02886 8I	W73-03248 3F
Aggregate Returns from Water Resource		FRIEDHOFF, J. M.
Development in Georgia, 1946 -1965, W73-02919 6B	FILMER, R. W. Virus-Sized Particle Adsorption on Soil-Part I: Rate of Adsorption,	Organochlorine Insecticide, Herbicide and Polychlorinated Biphenyl (PCB) Inhibition of
ESHEL, A.	W73-03177 5B	Nakatpase in Rainbow Trout,
Variations in Sodium Uptake Along Primary	Server Verser I Island and Sulming Distinct	W73-03165 5C
Roots of Corn Seedlings,	FLAXMAN, E. M.	FRISHKORN, G. W.
W73-03085	Predicting sediment yield in Western United States.	Evaluation of Ion-Exchange Surveillance Sam-
ESSIG, T. H.	W73-02795 2J	pler for Analyzing Radioactive Liquid Ef-
Evaluation of Environmental Factors Affecting	June 14 De De June 14 De June 15	fluents, W73-02753 SA
Population Exposure,	FLEMING, GEORGE	W73-02753 5A
W73-02733 5B	Application of Hydrologic Simulation to Water Resources Planning.	FUKE, H. General Purpose Program of Plane Stress Anal-
ESSINGTON, E. H.	W73-03236 6A	ysis by Finite Element Method, and its Appli-
Distribution of Radioactivity in and Near the		cation,
Rainier Rubble Chimney,	FLIS, J.	W73-02852 8A
W73-02723 5B	Changes in the Peripheral Blood in Carp	PHI PPRON W
Long Term Release of Radioactivity from Rainier Melt-Glass,	(Cyprinus Carpio L.) Under the Influence of Ammonium Liquor (Zmiany we Krwi Ob- wodowej Karpis (Cyprinus Carpio L.) Pod	FULKERSON, W. Survey of the Mercury Reprocessing Industry, 1968-1970,
W73-02727 5B	Wplywem Wody Amoniakalnesj, W73-03158	W73-02931 5G
EVERHART, W. H.	W73-03158 5C	FURUTA, Y.
Toxicity of Aluminum Hydroxide Complexes in	FONTES, M. R.	Determination of Total Mercury in Sludge (In
Neutral and Basic Media to Rainbow Trout, W73-02951 5C	Vegetable Production Under Plastic on the Desert Seacoast of Abu Dhabi,	Japanese), W73-02945 5A
ABER, H. A.	W73-03110 3F	FUXELIUS, K. O. H.
Water-Treatment-Plant Waste DisposalAction	FORD, H. W.	Process and a Product for the Purification of
Now,	The Use of a Multi-Celled Apparatus for	Polluted Water from Heavy Metal Ions Present
W73-02964 5F	Anaerobic Studies of Flooded Root Systems, W73-03194	Therein, W73-02992 5D
AIRCHILD, W. D.	The Association of Talleria Carron, and	Cippude a v 7 Milana and control
The Importance of a Practical Research Input to Water Resources Development, W73-02878 6B	FORSLOW, E. J. Distribution of Radioactivity in and Near the Rainier Rubble Chimney,	GABRYSCH, R. K. Development of Ground-Water Resources in the Orange County Area, Texas and Louisiana,
The characters of all story disorder model and the	W73-02723 5B	1963-71, W73-03139 4B
AN, L. T. Compilation of Water Quality Data and	TORONTO MI A STATUM IN MINISTER A STATE	# 73-03139 4B
Parameters from Kansas Rivers and Streams, W73-02973 5A	FORSTER, W. O. Radioactive and Stable Nuclides in the Columbia River and Adjacent Northeast Pacific	GAGNAIRE, J. RU106 Distribution in a Reduced Model Simulating River Banks; Some Hydrodynamic and
ANELLI, M.	Ocean,	Kinetic Aspects of Its Adsorption on Sedi-
Further Considerations on the Dynamic	W73-02745 5B	ments (Repartition Du RU106 Dans Un Modele
Behaviour of Hydraulic Turbomachinery, W73-02846 8C	FOSTER, E. T. JR Improved River Basin Utilization Through	Reduit Simulant Les Berges D'Une Rivi ere), W73-02724 5B
	Systems Analysis,	GAIGALAS, K. S.
ANG, C. S.	W73-02665 6A	Growth Characteristics, Structure and
Thermal Effects of the Surry Nuclear Power Plant on the James River, Virginia; Part II:	FOX, R. C.	Abundance of Abramis Brama (L.) In the
Results of Monitoring Physical Parameters of	Some Ecological Notes on Lotic Dipteran	Water Passages of the Summer Diked Marshes
the Environment Prior to Plant Operation,	Emergence in Prater's Creek, South Carolina,	of the Nyamunus Delta (In Russian), W73-02678
W73-02767 5C	W73-03162 5C	
AST, E. J.	FRACOIS, L. E.	GALICHEVA, E. E.
Jet Boat - Tellurometer Technique for Measur- ing Streamflow in Large Rivers,	Interaction of Temperature and Salinity on Sugar Beet Germination,	Manganese, Zinc and Copper Content in Or- gans and Tissues of Carp Underyearlings, (In Russian),

W73-03084

Sugar Beet Germination,
W73-03084 3C

W73-02884

FAST, E. J.

W73-02646

GALLEZ, B.	GHEORGHITZA, ST. I.	GORELOV, D. N.
Trajectory of Floating Bodies in a Strongly	On the Plane Steady Flow Through In-	Calculation of Generalized Hydrodynamic
Deviating Fluid Vein, (Trajectoire de corps	homogeneous Porous Media,	Forces for Kaplan Turbine Blades Oscillating
flottants dans une veine fluide fortement	W73-02824 2F	in the Liquid Flow, W73-03030
device),	GHILAROV, A. M.	W73-03030 8B
W73-03035 8B	Relations Between Biomass and Species Diver-	GOTTMAN, W.
GALLMAN, W. B.	sity in Marine and Freshwater Zooplankton	Public Water Supply Districts: Evaluation of a
Soil Associations and Land Classification for	Communities,	New Institution,
Irrigation, Lincoln County,	W73-02967 5C	W73-02918 6E
W73-02623	CHIEDWAY B B	GRAF, W. H.
GAMBLE, H. B.	GHILDYAL, B. P. Influence of Shape of Implements on Soil	Drag Coefficient and Turbulence Charac-
A Comparison of Public and Resource Ad-	Structure,	teristics,
ministrator Visual Perceptions of an Outdoor	W73-03203 2G	W73-03023 8B
Water-Based Recreation Area,	Cardia M. Suerial Inc. role (abrest)	GRAHAM, J. B.
W73-02612 6B	GHORASHY, S. R.	Temperature Sensitivity of Two Species of In-
GAMBLE, J. F.	Salt Tolerance of Safflower Varieties (Carthamus tinctorius L.) During Germination,	tertidal Fishes,
An Ecological Approach to Marine Radiologi-	W73-03088 3C	W73-02762 5C
cal Monitoring At the Florida Power Corpora-	W13-03000	GRAHAM, K.
tion Crystal River Nuclear Plant,	GILMAN, H. D.	Mercury Pollution of Golf Course Lakes,
W73-02737 5B	An Experiment in Computer-Assisted Super-	W73-02615 5B
CARDVER I B	visory Control of a Water Distribution System,	
GARDNER, L. R. Pediments and Terraces along the Moapa Val-	W73-02871 4A	GRCIC, J.
ley, Clark County, Nevada,	GINSBURGH, L	Critical Water Depth for Hydrodynamic In-
W73-03146 2J	Method and Apparatus for Removing Oil and	duced Oscillation of Cantilevered Cylinders, W73-03055 8B
Gorge / White in Committee Applications or special	Debris from Water,	W 73-03033
GARLAND, J. H. N.	W73-02997 5G	GREENE, J. B. JR
An Approach to the Problem of Pollution and	OT COORDINA III A	Reduction of Oil Spills During Shipboard Fuel
Fisheries,	GLOOSCHENKO, W. A. Diel Periodicity of Chlorophyll a Concentration	Movement Evolutions,
W73-03163 5C	in Oregon Coastal Waters,	W73-02907 5G
GARNER, C. R.	W73-02970 5C	GRIFFITH, W. L.
Catfish Production in Southeastern Arkansas:	a delegation of the man feel during the	Effect of Brine Disposal Cost on Hyperfiltra-
Estimated Investment Requirements, Costs,	GODWIN, M. R.	tion Plant Optimization,
and Returns, for Two Sizes of Farms,	Risk Programming: An Aid in Planning Reser-	W73-02914 5E
W73-02926 3E	voir-Irrigation Systems, W73-03248 3F	GROENEVELT, P. H.
GARNSEY, M. E.	W73-03248 3F	The Significance of the Net Transfer of
New Towns for the Southwest,	GOEDKOOP, J. A.	Viscous Stress Energy and the Local Produc-
W73-03125 6B	Environmental Effects Specific to Nuclear	tion of Kinetic Energy in Stationary Soil Water
1X1120-1130	Power Production,	Flow, W73-02821 2G
GATES, D. M.	W73-02774 5C	W73-02821 2G
Future Environments of Arid Lands of Southwestern States,	GOLDSTEIN, R. J.	GRUTSCH, J. F.
W73-03119 6B	Observations and Other Characteristics of	Oil-Water Separating Process,
VI LIGHTAN	Thermals,	W73-02999 5G
GAUSMAN, H. W.	W73-02757 8B	Process for Removing Contaminants from
Effects of Salt Treatments of Cotton Plants	COLECY	Waste-Water,
(Gossypium hirsutum L.) on Leaf Mesophyll	GOLE, C. V. Hydrodynamic Forces Caused by Unsteady	W73-03003 5D
Cell Microstructure, W73-03081 3C	Slot Flow on Vertical Leaf Gates,	5. New Approach his Water Beckerolds -
	W73-03045 8B	GUEGUENIAT, P.
GAVRILA, L.		Insoluble Species and Polymerization of Nitrato Complexes of Nitrosylruthenium in Sea
Considerations Regarding Distribution of	GOODIN, J. R.	Water (Nouvelles Etudes Sur Les Formes In-
Phytoplankton in the Crapina-Jijila Marshy	Interaction of Temperature and Salinity on Sugar Beet Germination,	solubles Et Sur Les Phenomenes De
Complex, (In Rumanian), W73-02686 2I	W73-03084 3C	Polymerisation Des Nitratocomplexes Du
WYS-SSIRE STILL A TO A COURT	770000	Nitrosylrut henium En Eau De Mer),
GELHAR, L. W.	GOODMAN, G. J.	W73-02731 5B
Gravitational and Dispersive Mixing in	Sewage Treatment Apparatus,	GUNSALUS, R. P.
Aquifers,	W73-02987 5D	Microbial Modification of Ground Water,
W73-02791 2F	GOODMAN, M. Y.	W73-02602 5B
GEMMELL, M.	An Experiment in Computer-Assisted Super-	GUPTA, G. P.
Water and Our Future: An Urban Planning	visory Control of a Water Distribution System,	Transistorized Level Switching Circuits (On
Manual for Local Officials,	W73-02871 4A	Off Controller) and their Possible Applications
W73-02872 6B	COONVEAR C B	to Water Reservoir: II,
CENCLED W.C.	GOODYEAR, C. P. A Simple Technique for Detecting Effects of	W73-03198 4A
GENSLER, W. G. A Plastic Inflated Environmental Growth	Toxicants or Other Stresses on a Predator-Prey	GURTMURTOV, D.
Chamber,	Interaction,	Soils of Northern Turkmenistan and Some of
W73-03095 3F	W73-03161 5C	their Agricultural Features (In Russian),
		W73-03210 2G
GERDEMANN, J. W.	GORBAN, I. M. On the Equilibrium of a Cable Connected to a	GUY, H. P.
Nutrient Status and Mycorrhizal Enhancement of Water Transport in Soybean,	Free-Floating Body Placed in a Stream,	Urban SedimentationIn Perspective,
W73-03087 3F	W73-03062 8B	W73-02793 2J

An Approach to the Problem of Pollution and

HART, I. C.

HABACIVCH, WILLIAM HABACIVCH, WILLIAM

Water Resources Management in Delaware,

W73-02622 6B	W73-03163 5C	W73-03040 2E
HACKMAN, R. J.	W 75-03103	W 73-03040 2E
Map Showing Drainage Basins and Historic	HARTUNG, R.	HERNANDEZ, J. W.
Cloudburst Floods in the Salina Quadrangle,	Environmental Dynamics of Mercury,	Agricultural Wastes in Arid Zones,
Utah,	W73-02729 5B	W73-03128 SF
W73-03152 7C	may at Maries and Presidential Mileston	
W/3-03132	HASSOUNA, N. A-H.	HERRMANN, R.
HAGIST, W. M.	The Use of Quaternary Ammonium Resin-	Shallow Aquifers Relative to Surface Waters,
Diffusion of Thermally Buoyant Water Jets	Triiodide Complex to Inactivate Virus and	North Platte River Valley, Goshen County,
into a Moving Water Stream,	Selected Bacteria,	Wyoming,
W73-02627 5B	W73-03188 5F	W73-02900 4B
FERRIS IS W	WARRISON O. I.	LONG STREET, ST.
IAIRR, L. M.	HATLEBERG, C. J.	HERSHBERGER, W. K.
Environmental Sampling for River Sediments	Characterization and Treatment of Bilge and	Low Level Chronic Irradiation of Salmon. An-
Around a Nuclear Power Station,	Ballast Water,	nual Progress Report,
W73-02740 5B	W73-02905 , 5G	W73-02714 5C
WTD CTW	HAVAS, P.	***************************************
HALBROOK, W. A.	The Water Economy of the Bilberry (Vaccini-	HESS, H. V.
Catfish Production in Southeastern Arkansas:	um myrtillus) Under Winter Conditions,	Eradicating Oil Slicks, W73-02996 5G
Estimated Investment Requirements, Costs,	W73-02705 21	W73-02996 5G
and Returns, for Two Sizes of Farms,	Carrier Self-drived way to be reserved about	Freezing Oil Spills,
W73-02926 3E	HAYASHI, M.	W73-03013 5G
IALE, J. G.	Pollution by Coliform Bacteria in Sea Water of	11 13 33013
	Swimming Resorts: II (In Japanese),	HESS, J. W.
Culture of the Yellow Perch in the Laboratory,	W73-02928 5B	Role of Vertical Shafts in the Movement of
W73-02952 5G	Wasterland - Wasterland	Ground Water in Carbonate Aquifers,
HALEK, V.	HAYASHI, Y.	W73-02803 2F
Problems Concerning Solution of Steady and	Determination of A Trace Amount of Cadmium	May a display An artist of the later teach, A.V.
Unsteady Groundwater Flow by Statistical	in Water by Atomic Absorption Spec-	HETLING, L. S.
Methods.	trophotometry Combined with Ammonium Pyr-	Sources of Nutrients in Canadarago Lake,
W73-02826 2G	rolidine Dithiocarbamate-Methl Isobutyl	W73-02859 5C
W 13-02020	Ketone Extraction Using Large Aqueous	NAME OF TAXABLE PARTY.
HALVORSON, W. L.	Phase/Solvent Rati os,	HILDRETH, C. T.
Environmental Influence on the Pattern of	W73-02939 5A	Location of Wells and Test Holes, Hartford
Plant Communities Along the North Rim of the	som Programming An Ald In Planting Bern.	North Quadrangle, Connecticut,
Grand Canyon,	HEANEY, J. E.	W73-03153 7C
W73-03078 2I	Benefits of Flow Augmentation for Water	
W 75-03076	Quality Control,	HILL, R. W.
HANNA, L. W.	W73-03242 5G	A Self-Verifying Hybrid Computer Model of
The Effects of Water Availability on Tea	HECKER, G. E.	River-Basin Hydrology,
Yields in Uganda,	Hydrodynamic Forces on Single Intake Gates,	W73-03183 2A
W73-02696 3F	W73-03046 8B	MALESTAN
11.5-02050	W 75-05040	HILL, W. F. JR
HANNAHS, B. J.	HEJLESEN, E.	Detection of Viruses in Water: A Review of
Bibliography on Handling, Control and Moni-	Plastic Covering and Irrigation of Early	Methods and Application,
toring of Tritium (Dec. 1968-Jan. 1972),	Potatoes,	W73-03174 5A
W73-02708 5B	W73-02675 3F	HINES, C. O.
	WHITE CHINGS A C W	Eddy Diffusion Coefficients due to Instabilities
HARDIE, M. G.	HELLQVIST, A. U. W.	in Internal Gravity Waves,
A New Approach for Water Reclamation -	Apparatus for Biologically Purifying Sewage,	W73-02776 2E
Complete Treatment of Waste Water by	W73-03014 5D	11.5-021/0
Physico-Chemical Processes,	HENDROVO D. W	HINKLEY, K. C.
W73-02607 5D	HENDRICKS, D. W.	Geology, Soils, and Hydrogeology of Volo Bog
A SERVICE SELECT SECURITY SHOWS	Sorption in Flow Through Porous Media, W73-02839 2G	and Vicinity, Illinois.
HARDY, E. E.	W73-02839 2G	W73-02657 2H
A Land-Use Classification System for Use	HENDRICKS, J. R. JR	Application of the property of the party of
With Remote-Sensor Data,	Application of a Digital Hydrologic Simulation	HIRAI, G. I.
W73-02649 7B	Model to an Urbanized Watershed,	A Physiological Study on Variations of Dry
HARDY, K.	W73-02946 2A	Matter Percent of Tuber in Sweet Potatoes (In
		Japanese),
Plastic Covering and Irrigation of Early	HENDRICKS, S. B.	W73-02692 3F
Potatoes, W73-02675 3F	Rehydration of Phytochrome in Imbibing Seeds	HODGE G O
W/3-020/5	of Amaranthus retroflexus L.,	HODGE, C. O.
HARGIS, W. J. JR	W73-03086 2I	An Integrated System for Providing Power,
Thermal Effects of the Surry Nuclear Power	HENDY P M	Water and Food for Desert Coasts, W73-03099 3F
Plant on the James River, Virginia; Part II:	HENRY, E. M.	W73-03099 3F
Results of Monitoring Physical Parameters of	Comprehensive Survey of Elk River Basin,	HODGES, C. N.
the Environment Prior to Plant Operation,	Volume II, Economic Base Study,	An Integrated System for Providing Power,
W73-02767 SC	W73-02860 6D	Water and Food for Desert Coasts,
The state of the s	HENRY, K. A.	W73-03099 3F
HARRISON, M. J.	Estimates of Maturation and Ocean Mortality	11,3-03035
Solubilization of inorganic phosphate by bac-	for Columbia River Hatchery Fall Chinook Sal-	HOGAN, J. W.
teria isolated from upper Klamath Lake sedi-	mon and the Effect of No Ocean Fishing on	Metabolism of Diazinon by Fish Liver
ment.	Yield.	Microsomes,
W73-02954 SC	W73-02927 81	W73-03167 5C
The state of the s	18 M 18 19 19 19 19 19 19 19 19 19 19 19 19 19	761 Mark 18060-170

HOGG, R. M. Waste Mana W73-02734

HERBICH, J. B.
Non-Steady Flow on Sloping Beach with Large

Acidity and Young Atlan posed to Hig W73-03170 Effects of Anaesthesia Reactions of

Environmen Dioxide Ten W73-03169 HOLLAND, N Experiment Overland F W73-03018

HONSTEAD, Evaluation Population W73-02733

HOOVER, L. vironmenta W73-02915 HORENI, P.

Hydraulic Caused by W73-03043 HORNBERG

The Deter Stream Us Balance E W73-02971

HORTON, E Multi-Disc Relationsh Oregon, W73-0292

HOUGH, R. A C-14 A Plants, W73-0297 HOWARD,

Transport Suspensio W73-0260 HOWELL,

And-Ice W73-028 HSU, S-T.

Hydrody to Barge W73-030

HUANG, J A New Complete Physico-W73-026

HUBER, A A Self-V River-Ba W73-031

HOGG, R. M.	HUBERT, P.	Contribution to the Study of the Possibilities of
Waste Management, W73-02734 5B	Tritium in Investigation of Surface Hydrology. Experimental Determination of Coefficient of	Introducing Pyrethrum Cinerariaefolium Trev. In Servia and Voyvodina: Second Report,
W/3-02/34	Runoff.	W73-02671 3F
HOGLUND, L. B.	W73-02713 5B	Philippin Operations for the
Acidity and Lactate Content in the Blood of	HUFSCHMIDT, M. M.	JACOBY, B.
Young Atlantic Salmon (Salmo salar L.) Exposed to High pCO2,	Perspectives and Goals for Water Resource	Sodium Export From Bean Leaves as Affected by the Mode of Application,
W73-03170 5C	Planning,	W73-03073 2I
The state of the s	W73-03182 6B	Control of the contro
Effects of Locomoter Restraint and of Anaesthesia with Urethane or MS-222 on the	HULL, H. M.	JAUHRI, K. S. Seed Pelleting in Relation to Nodulation and
Reactions of Young Salmon (Salmo salahrL.) to	Morphological Response of Two Mesquite	Nitrogen Fixation by Phaseolus aureus L. in a
Environmental Fluctuations of pH and Carbon	Varieties to 2,4,5-T and Picloram,	Saline Alkali Soil,
Dioxide Tension,	W73-03080 4A	W73-03097 3C
W73-03169 5C	HUNT, E. P.	JENSEN, M. H.
HOLLAND, M. E.	Changes in the Blood of the Brown Bullhead	A Hydrophilic Polymer as a Soil Amendment,
Experimental Investigation of Converging	(Ictalurus nebulosus (Lesueur)) Following	W73-03098 2G
Overland Flow,	Short and Long Term Exposure to Copper (II), W73-02947 5C	Scrubbed Diesel Exhaust for Carbon Dioxide
W73-03018 2E	W 13-025-41	Enrichment of Greenhouse Vegetables.
HONSTEAD, J. F.	HUSAR, R. B.	W73-03074 3F
Evaluation of Environmental Factors Affecting	Observations and Other Characteristics of Thermals.	Vanishla Budustian Hades Blacking on the
Population Exposure,	W73-02757 8B	Vegetable Production Under Plastic on the Desert Seacoast of Abu Dhabi,
W73-02733 5B		W73-03110 3F
HOOVER, L. J.	HWANG, C. L. Compilation of Water Quality Data and	TERMET OU A
The Relationship Between Land Use and En-	Parameters from Kansas Rivers and Streams,	JERNELOV, A. Environmental Dynamics of Mercury,
vironmental Protection, W73-02915 4A	W73-02973 5A	W73-02729 5B
47	*****	
HORENI, P.	ILAN, I. Evidence for Hormonal Regulation of the	JOHAM, H. E.
Hydraulic Downpull Increase at a Dam Gate	Selectivity of Ion Uptake by Plant Cells,	The Influence of Low Substrate Sodium Levels Upon the Free Amino Acid Content of Cotton
Caused by Hydrodynamic Forces, W73-03043 8B	W73-03113 2I	Leaves,
MARKATA TANANTANA	IORGANSKII, A. I.	W73-03089 3C
HORNBERGER, G. M.	Soils of Piedmont Debris Cones and the Possi-	JOHN, J.
The Determination of Primary Production in a Stream Using an Exact Solution to the Oxygen	bilities for their Agricultural Utilization (In	Application of CF252 to the Detection of
Balance Equation,	Russian),	Heavy Metals for Pollution Control,
W73-02971 5C	W73-03209 2G	W73-02738 SA
HORTON, H. F.	ISHII, S.	JOHNS, B.
Multi-Disciplinary Study of Water Quality	Pollution by Coliform Bacteria in Sea Water of	The Decay and Stability of Internal Wave
Relationships: A Case Study of Yaquina Bay,	Swimming Resorts: II (In Japanese), W73-02928 5B	Modes in a Multisheeted Thermocline,
Oregon,		W73-02759 5G
W73-02921 5C	ISLAM, M. N.	JONES, B. G.
HOUGH, R. A.	Comprehensive Survey of Elk River Basin, Volume II, Economic Base Study,	Transport Processes of Particles in Dilute
A C-14 Assay for Photorespiration in Aquatic	W73-02860 6D	Suspensions in Turbulent Water Flow - Phase
Plants, W73-02978 5C	TOOL ATT. A	II, W73-02605 8B
11.5-025.18	ISOLATI, A. Methyl Mercury Acetate From Waters by	
HOWARD, N.	Chromatography on Chelating Polymers,	JONES, D. E. JR
Transport Processes of Particles in Dilute Suspensions in Turbulent Water Flow - Phase	W73-03179 5A	Urban SedimentationIn Perspective, W73-02793 2J
II,	ISRAELSEN, E. K.	413-0273
W73-02605 8B	A Self-Verifying Hybrid Computer Model of	JONES, K.
HOWPLI W P	River-Basin Hydrology,	Comparison of Analytical and Structural Behavior Results for Morrow Point Dam.
HOWELL, W. E. Impact of Snowpack Management on Snow-	W73-03183 · 2A	W73-02847 8A
And-Ice Hydrology,	ISU, E. O.	Marian Control
W73-02851 3B	Improved River Basin Utilization Through	JONES, W. T. Method of Recovering Oil form an Oil Slick,
HSU, S-T.	Systems Analysis, W73-02665 6A	W73-03007 5G
Hydrodynamic Forces on Diffuser Pipes Due	W 73-02863	
to Barge Passage,	ISWARAN, V.	JOOSTING, P. E.
W73-03032 8B	Seed Pelleting in Relation to Nodulation and Nitrogen Fixation by Phaseolus aureus L. in a	Biological Effects of Air Pollution, W73-02773 5C
HUANG, J. C.	Saline Alkali Soil.	
A New Approach for Water Reclamation -	W73-03097 3C	JORDAN, W. R.
Complete Treatment of Waste Water by	IVANIC, R.	An Effect of Water Stress on Ethylene Produc- tion by Intact Cotton Petioles,
Physico-Chemical Processes, W73-02607 5D	Contribution to the Study of the Possibilities of	W73-03112 3F
W 13-02001	Introducing Dalmatian Pyrethrum (Pyrethrum	
HUBER, A. L.	Cinerariaetolium Trev.) In Serbia and Voyvodina: 3rd Report. The Influence of	JORGENSEN, V. Plastic Covering and Irrigation of Early
A Self-Verifying Hybrid Computer Model of River-Basin Hydrology,	Voyvodina: 3rd Report. The Influence of Growing Site on the Percentage of Pyrethrine s,	Postatoes,
W73-03183 2A	W73-02672 3F	W73-02675 3F

KLINGEMA Bed-Load W73-02893 KLOCK, J. V Discussion W73-03125 KLOTZ, D. Model To Using Rad W73-02838 KLUMP, D. Aerating / W73-0298 KLUTE, A. Patterns of W73-0311 KNAAK, L. Productio Methylbo W73-0294 KNOWLES Metabolis Microson W73-0316 KNUDSEN, Fouling: Heat Train W73-0277 KNUDSEN, Plastic Potatoes, W73-026 KNUTILLA Water fo ty--Oakla W73-028

KO, S. C. Drag C teristics, W73-030

Measure Velocity W73-027 KOCHENO Uranium ments in W73-027 KOCMON Project Warm F W73-027 KOEHNLI Investig Vertical in Schle W73-026 KOIRTYC Mercury W73-026 KOMARO Some I veniles Breedin W73-02

SC SC

WA	BIV	EW	, F.	M
20	100			F0.0

KABIYEV, F. K. Prospects of Using Groundwaters Along the Ir- tysh River Near Semipalatinsk in the National	USSR and the Academy of Science of the MP R, (In Russian), W73-02882 2I	KEUNE, C. H. Location of Wells and Test Holes, Hartford North Quadrangle, Connecticut,
Economy (Perspektivy ispol'zovaniya podzem-	KATO, N.	W73-03153 7C
nykh vod Semipalatinskogo Priirtysh'ya v	Process of Purifying Water by Irradiating It,	KHAN, M. S.
narodnom khozyaystve), W73-02812 4B	W73-02982 5D	Performance of Rainfed American Cotton
	KAZANTIS, G.	(Gossypium hirsutum L.) under Three Sowing Times, Three Row Spacings and Three
ADYROV, N. B. Origin of Manganese Nodules of the Pacific	The Poison Chain for Mercury in the Environ-	Nitrogen Levels in Nimar Tract of Madhya
Ocean From Radioisotope Data,	ment,	Pradesh,
W73-02752 5B	W73-03202 5B	W73-03201 3F
CAEUFER, E. A.	KEGGI, K. J.	KHERADNAM, M.
Codorus Creek Water Quality Investigation Re-	An Epidemiological Study of the Effect of	Salt Tolerance of Safflower Varieties
port,	Fluorides in Drinking Water on the Frequency of Slipped Capital Femoral Epiphysis,	(Carthamus tinctorius L.) During Germination, W73-03088
W73-02870 5G	W73-03071 5F	W. LO WELLIN
KALACHEV, N. S.	KELLER, K. J.	KHUZEEVA, L. M.
Optimization of Basin Water Resources Utiliza-	Discharge of Waste Heat,	Fish of the Kuibyshev Reservoir (In Russian), W73-03083
tion, W73-03228 4A	W73-02770 5C	MCC-1-1-1
	KELLER, R. M.	KINCAID, G. P. JR Contemporary Sources and Geochemistry of
Clobal Hudrology	Effect of Brine Disposal Cost on Hyperfiltra-	Tritium in the Gulf of Mexico and its Distribu-
Global Hydrology, W73-03057 2A	tion Plant Optimization,	tive Province,
	W73-02914 SE	W73-02730 5B
Groundwater of the Akdala River Valley and	KELLY, M. G.	KING, P. H.
Prospects of its Use as a Water-Supply Source (Podzemnyye vody doliny r. Akdala i perspek-	The Determination of Primary Production in a Stream Using an Exact Solution to the Oxygen Balance Equation,	The Effect of pH on Aerobic Sludge Digestion, W73-02897 5D
tivy ikh ispol'zovaniya dlya vodosnabzheniya), W73-02817	W73-02971 5C	Effect of Reservoir Drawdown on Optimal
W73-02817		Operation, W73-03244 4A
CAMESWARA RAO, N. S. V.	KELLY, R. E. Wave-Induced Boundary Layers in a Stratified	A STATE OF THE STA
Accelerated Motion of a Sphere in an Oscillat- ing Fluid,	Fluid,	Effects of Reservoir Operating Policy on Recreation Benefits,
W73-03028 8B	W73-02761 8B	W73-02618 6B
AN M C	KELSEY, J. L.	
KAN, M. S. Underground Mineral Water of Alpine Regions of Southeastern Kazakhstan (Podzemnyye mineral'nyye vody vysokogornykh rayonov	An Epidemiological Study of the Effect of Fluorides in Drinking Water on the Frequency of Slipped Capital Femoral Epiphysis,	KINOSHITA, M. Process of Purifying Water by Irradiating It, W73-02982 5D
Yugo-Vostochnogo Kazakhstana),	W73-03071 5F	KINOSHITA, S.
W73-02818 4B	KEMPTON, J. P.	Process of Purifying Water by Irradiating It,
KANBAYASHI, N.	Geology, Soils, and Hydrogeology of Volo Bog	W73-02982 5D
Pollution by Coliform Bacteria in Sea Water of	and Vicinity, Illinois.	KIRBY-SMITH, W. W.
Swimming Resorts: II (In Japanese),	W73-02657 2H	Growth of the Bay Scallop: The Influence of Experimental Water Currents,
W73-02928 5B	KENNANEH, A.	W73-02702 2L
KANID'EV, A. N.	Troubled Waters, Lake Erie 1971, W73-02743 5B	
Raising Salmon in the Inland Waters of Japan,	W 13-02143	KIREEV, A. F. A Southern Outpost of Steppe Ravine Forest in
(In Russian), W73-02899 81	KENNARD, M. F.	Semi Desert (In Russian).
WATER TO SELECT THE SE	Examples of the Internal Condtions of Some Old Earth Dams,	W73-02758 4A
ANKE, M.	W73-02841 8A	KISIEL, C. C.
Determination of A Trace Amount of Cadmium in Water by Atomic Absorption Spec-	KENNEDY, A. S.	Data Collection for Water Systems Control,
trophotometry Combined with Ammonium Pyr-	The Relationship Between Land Use and En-	W73-03241 7C
rolidine Dithiocarbamate-Methl Isobutyl	vironmental Protection,	KITE, G. W.
Ketone Extraction Using Large Aqueous Phase/Solvent Rati os,	W73-02915 4A	Great Lakes Simulation ModelA Decision
W73-02939 SA	KENNEDY, J. F.	Aid, W73-03234 2H
TANKS WITH MANAGEMENT AND THE PROPERTY OF THE	Stability of Floating Ice Blocks,	100,000
APELYUSH, V. A. The Effect of Drought on Potato Yields in the	W73-02792 2C	KLABUKOV, V. M. Moment Characteristics of Cascades Under
Ukrainian SSR (In Russian),	KERR, J. A.	Nonstationary Flow Conditions,
W73-02690 3F	Multireservoir Analysis Techniques in Water	W73-03029 8B
KARPENKO, G. I.	Quantity Studies, W73-02664 4A	KLEIN, E.
Oxygen Consumption of Larvae and Juveniles		Concentration of Viruses by Osmotic Ultrafil-
of the Carp Family in Relation to Their Ecolo-	KERR, JOHN A. Preliminary Analysis of Surface Water Availa-	tration: A Preliminary Report on the Develop-
gy, (In Russian), W73-02682	bility,	ment of a Model System, W73-03176 5A
	W73-03233 4A	
KASHAPOV, R. S. Flood Plain Vegetation of the Middle Regions	KERSHNER, C. J.	KLEKOWSKI, R. Z. The Influence of Herbicide 2,4-D-NA on
of the Kerulen River (From Information of the	Bibliography on Handling, Control and Moni-	Respiration and Survival of Simocephalus vetu-
Joint Soviet-Mongolian Complex Biological Ex-	toring of Tritium (Dec. 1968-Jan. 1972),	lus (O.F. Muller) (Cladocera),
pedition of the Academy of Science of the	W73-02708 5B	W73-03166 5C

5B

KLINGEMAN, P. C. Bed-Load Transport in Mountain Streams, W73-02893 2J	KOOLEN, J. L. Biological Effects of Cooling Water Discharge, W73-02772 5C	LACAMBRE, O. Quality of the Water Used for Human Consumption (In French),
KLOCK, J. W. Discussion of Waste Disposal in Arid Lands, W73-03129 5F	KOSTJAL, E. L. Water for Southern Nevada, W73-02848 6D	W73-03204 5G LACEY, J. M. Oil Spill Characteristics and Statistics,
KLOTZ, D. Model Tests to Study Groundwater Flows Using Radioisotopes and Dye Tracers, W73-02838 2F	KRAMER, M. A. Comparison of Analytical and Structural Behavior Results for Morrow Point Dam, W73-02847 8A	W73-02906 5G LACHET, B. RU106 Distribution in a Reduced Model Simulating River Banks; Some Hydrodynamic and
KLUMP, D. Acrating Apparatus, W73-02984 5D	KRIEGER, H. L. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effluents.	Kinetic Aspects of Its Adsorption on Sedi- ments (Repartition Du RU106 Dans Un Modele Reduit Simulant Les Berges D'Une Rivi ere), W73-02724 5B
KLUTE, A. Patterns of Water Uptake and Root Distribu- tion of Soybeans (Glycine max.) in the Presence of a Water Table, W73-03114 3F	W73-02753 5A KRISHNAMURTHY, M. Equivalent Roughness for Shallow Channels, W73-02786 8B	LAHAYE, P. A. Calcium and Salt Toleration by Bean Plants, W73-03094 3C
KNAAK, L. E. Production of Geosmin and 2-Exo-Hydroxy-2-Methylbornane by Streptomyces odorifer, W73-02949 5A	KRISHNAN, P. Systems Approaches to Microscale Problems of Water Pollution Control, W73-03223 5G	LAND, L. F. Annual Compilation and Analysis of Hydrologic Data for Urban Studies in the San Antonio, Texas Metropolitan Area, 1970, W73-03148 7C
KNOWLES, C. O. Metabolism of Diazinon by Fish Liver Microsomes, W73-03167 5C	KRIVCHENKO, G. I. Moment Characteristics of Cascades Under Nonstationary Flow Conditions, W73-03029 8B	LARIMORE, R. W. Physico-Chemical Limnology and Periphyton in a Warm-Water Stream Receiving Wastewater Treatment Plant Effluent,
KNUDSEN, J. G. Fouling: The Major Unresolved Problem in Heat Transfer, W73-02775 8B	KROONTJE, W. Effects of Detergent Polluted Water on Soil Reaction and Plant Growth, W73-02620 5C	W73-02603 5D LAWES, B. C. Process for Detoxifying Cyanide Waste Waters,
KNUDSEN, K. Plastic Covering and Irrigation of Early Potatoes, W73-02675 3F	KRYUCHKOV, V. A. Group Analysis of Impurities in Recalimed Water (In Russian), W73-03246 5A	W73-02989 5D LAWROSKI, S. Fuel Cycles and the Fast Breeder Reactor, W73-02765 5G
KNUTILLA, R. L. Water for a Rapidly Growing Urban Communi- ty-Oakland County, Michigan, W73-02804 3D	KRZECZKOWSKA-WOLOSZYN, L. Peculiarities of the Phytoplankton Species Composition of Some Forest Ponds, W73-02644 21	LEDGER, D. C. The Warwickshire Avon: A Case Study of Water Demands and Water Availability in an Intensively Used River System,
KO, S. C. Drag Coefficient and Turbulence Characteristics,	KULHAWY, F. H. Stresses and Movements in Oroville Dam, W73-02849 8D	W73-03103 6D LEE, K. H. An Ecological Study of the Soil Microfungi in a
W73-03023 8B Measurements of Turbulence in Water at High Velocity,	KUMAMARU, T. Determination of A Trace Amount of Cadmium in Water by Atomic Absorption Spec-	Hawaiian Mangrove Swamp, W73-03205 21 LEE, M-L.,
W73-02790 2E KOCHENOV, A. V. Uranium Concentration in Recent Ocean Sediments in Zones of Rising Currents,	trophotometry Combined with Ammonium Pyr- rolidine Dithiocarbamate-Methl Isobutyl Ketone Extraction Using Large Aqueous Phase/Solvent Rati os, W73-02939 5A	Feasibility Study of the Application of Solvent Extraction and Gas-Liquid Partition Chro- matography to Marine Trace Metal Analysis, W73-02747 5A
W73-02748 5B KOCMOND, W. Project Fog Drops. Part 1: Investigations of Warm Fog Properties,	KUTATELADZE, S. S. The Structure of Turbulent Flows Adjacent to Walls, W73-03060 8B	LEE, T. P. Effect of Dissolved Salts on Water Solubility of Lindane, W73-03185 5G
W73-02782 2B KOEHNLEIN, J. Investigations into the Formation of Biogenetic Vertical Tubes in the Subsoil of Diked Marshes	KUTILEK, M. Non-Darcian Flow of Water in SoilsLaminar Region, W73-02836 2G	LEGGIO, V. J. Scrubbed Diesel Exhaust for Carbon Dioxide Enrichment of Greenhouse Vegetables, W73-03074 3F
in Schleswig-Holstein, (In German), W73-02687 21 KOIRTYOHANN, S. R.	KVON, V. I. Friction Forces of Unsteady Flows in Open Channels and Pipes,	LENNING, R. E. Pre-Impoundment Boating Activity in the Saylorville Reservoir Area,
Mercury Pollution of Golf Course Lakes, W73-02615 5B	W73-03041 8B LAABS, S. K.	W73-02912 6B LEVIN, L. Study of the Hydraulic Damping of the Vibra-
KOMAROVA, N. P. Some Data on the Respiration of Salmon Juveniles in Relation to the Biotechnique of Breeding, (In Russian), W73-02683 81	Analysis of the Effects on Oil Spills of Fuel Policy Changes and the Addition of Another Fuel Pier with the Aid of a Computer Sinaula- tion Model, W73-02908 5G	Study of the Hydraulic Damping of the Viora- tions of a Rod in the Turbulent Regime (Etude de l'amortissement hydraulique de la vibration d'une baguette en regime turbulent), W73-03054 8B

MADHOK, Solution e tions of a an Iterativ MAHONEY Precoat V Dewaterin W73-0296 MAKER, H Soil Asso Irrigation W73-0262 MAKSIMO Flood Pla of the Ke Joint Sov pedition USSR an R, (In Ru W73-0288 MALLATT Process Waste-W W73-030 MALLETT Periphyte Water Qu W73-026 MALONEY Missouri Law ar Proposed W73-032 North C lution L Proposes W73-032 Texas (/ and Con Tenness W73-032 MAMAEV Hydrock with Co izer, W73-027 MANHEIN Commu Planning W73-028 MANOHA Which Isopiest suremen als, W73-03 MAPP, H. An Eco tion in t W73-02 MARCE, Tritium

Experie Runoff,

W73-02

Clay Soil, W73-02834 2G

Study of Viscous Hydraulic Damping of Breathing Vibrations of a Cylindrical Shell in a Fluid at Rest (Etude de l'amortissement	LIZCANO, J. J. Compilation of Water Quality Data and Parameters from Kansas Rivers and Streams, w23.0923	LUKAWSKY, M. Flood Control Method and Apparatus, W73-03010 4A
hydraulique visqueux des vibrations de respira- tion d'une coque cylindrique dans un fluide au	W73-02973 5A	LUKENS, H. R.
repos), W73-03053	LJATKHER, V. M. The Impact of the Jet on the Obstacle,	Instruction Manual for Oil Slick Identification by Trace Element Patterns Measured with
LEWELLEN, G. R.	W73-03037 8B	Neutron Activation Analysis, W73-02715 5A
The Yellow Perch Fisheries of Deer Creek	LJISENKO, P. E.	A SANGE OF THE PROPERTY OF THE
Reservoir, Utah, with Notes on Parasitism by	On Hydroelastic Correlations Between Dif-	LUKIN, A. V.
Ligula Intestinalis, W73-02701 8I	ferent Forms of Oscillations of Plate in the Flow Boundary Resulting from Non-Uniform Distribution of Averaged Flow Velocity in	Fish of the Kuibyshev Reservoir (In Russian), W73-03083
LEWIN, J.	Depth,	LUPINOVICH, L.S.
Late-Stage Meander Growth,	W73-03049 8B	Soil Complexes in the East of the Brest
W73-02796 23	LODDO, M.	Polesie, (In Russian),
LEWIS, L.	A Method for the Determination of the Ther- mal Properties of Soil Near the Surface.	W73-03006 2G
The Terrestrial Radiological Monitoring Programs at Duke Power Company's Oconee and	W73-03076 2G	LYFORD, F. P. The Nature and Extent of Peat Deposits and
McGuire Nuclear Stations,	LOEHMAN, E.	Possible Effects of Peat Mining on Manmade
W73-02735 5B	Cost Allocation for A Regional Pollution Treat-	Features and Springs Near Mescalero, New Mexico.
LEWIS, O. JR	ment System, W73-02937 5G	W73-02661 4B
Arid Lands and Their Future,	W73-02937 5G	# 13-02001
W73-03123 6B	A New Theory of Pricing and Decision-Making for Public Investment,	LYON, W. A. Systems Approach to Water Pollution Control -
LIAO, K. H.	W73-02917 6B	A Discussion.
Thermodynamic Analogy of Mass Transport	The Determination of Territor Street Committee	W73-03224 5G
Processes in Porous Media,	LOESSNER, G. A.	DO RESIDENCE TO SERVICE TO SERVIC
W73-02819 2F	Water Resources Management in Delaware, W73-02622 6B	LYONS, E. T.
LICHEV, B.	W73-02622 6B	Development of Analytical Procedures for
Irrigation of Maize and Sunflower Grown as	LOFTIN, S. E.	Determining Chlorinated Hydrocarbon
Post-Harvest Silage Crops in the Region of	An Expansion Cloud Chamber Study of Water	Residues in Waters and Sediments From Storage Reservoirs,
Rossitza Irrigation System,	Evaporation, W73-02890 2B	W73-02844 SA
W73-02670 3F	to colocid. At 1977 with the state of the Monthly of the	MACAGNO, E. O.
LIEBERMAN, J. A.	LONGREE, W. D.	Extension of the Flow-Net Method to Un-
EPA, Environmental Legislation and Energy,	Loss of Pressure Due to Periodic Movement of an Obstacle (Sur la perte de charge due a un	steady Internal and External Flows, W73-03027
W73-02739 5G	obstacle en mouvement periodique),	W /3-0302/
LIM, C. L	W73-03020 8B	MACAGNO, M.
An Investigation into the Flow Behaviour Through Compacted Saturated Fine-Grained	LOUCKS, D. P. Systems Approach to Problems of Water Pollu-	Extension of the Flow-Net Method to Un- steady Internal and External Flows,
Soils with Regard to Fines Content and Over a Range of Applied Hydraulic Gradients,	tion Control, W73-03222 SG	W73-03027 8B
W73-02835 2G	W13-03222	MACHEMEHL, J. L.
Management of the second production of	LOUIE, S. S-F.	Non-Steady Flow on Sloping Beach with Large
LIN, S. H. Compilation of Water Quality Data and	Energy Input-Output Climates of the World: A	Roughness Elements,
Parameters from Kansas Rivers and Streams,	Preliminary Attempt, W73-02647 2B	W73-03040 2E
W73-02973 5A	to the second of	MACK, E.
might throught a pay in to their mindres.	LOWDER, W. M.	Project Fog Drops. Part 1: Investigations of
LIND, R. C.	Environmental Radiation Dosimetry Near Large Nuclear Power Stations,	Warm Fog Properties,
A Computer Simulation Model for Flood Plain Development, Part 1: Land Use Planning and	W73-02742 5B	W73-02782 2B
Benefit Evaluation,		MACK, W. N.
W73-02944 4A	LU, C. S.	The Occurrence and Possible Source of the
INDOTEN D. C.	A New Approach for Water Reclamation - Complete Treatment of Waste Water by	Coliform Bacteria on the Shoreline of Northern
LINDSTEN, D. C. Evaluation of Potable Water Storage Tanks,	Physico-Chemical Processes,	Lake Michigan,
W73-02656 SG	W73-02607 5D	W73-02606 5B
Acceptance of the control of the con	LUCIANO, A. J.	MACLEAN, A. H.
LITTLE, J. W.	Wet Oxidation of Nylon 6,6 by the Rotating	Available Water Capacities of Zambian Soils in
New Attitudes About Legal Protection for	Disk Technique,	Relation to Pressure Plate Measurements and
Remains of Florida's Natural Environment, W73-03216 6E	W73-03186 5D	Particle Size Analysis, W73-03065 2G
	LUCKEY, R. R.	
LIU, C-8, Flood Control Storage Allocations by Linear	A New Technique for Estimating Recharge	MACROBERTS, P. B. Modeling Discharge and Conservative Water
Programming,	Using a Digital Model, W73-02801 4B	Quality in the Lower Kansas River Basin,
W73-02667 4A		W73-02658 4A
LIU, M. S.	LUENBERGER, D. G.	MADEDOR A O
Oxygen Transfer to Water and to Sodium	A Computer Simulation Model for Flood Plain Development, Part 1: Land Use Planning and	MADEDOR, A. O. The Flow of Air and Water in Partly Saturated
Sulfite Solutions,	Benefit Evaluation,	Clay Soil,
W73-02962 5G	W73-02944 4A	W73-02834 2G

Sulfite Solutions, W73-02962 5G

MADHOK, B. R.	MARCHENKO, A. G.	MCMICHAEL, B. L.
Solution of Continuity and Momentum Equa-	Experimental Study of the Structure of Turbu-	An Effect of Water Stress on Ethylene Produc-
tions of a Travelling Hydraulic Jump by Using an Iterative Operator,	lent Boundary Layers in Incompressible Fluids in the Presence of a Longitudinal Pressure	tion by Intact Cotton Petioles, W73-03112 3F
W73-03150 8B	Gradient,	
	W73-03061 8B	MCMINN, J. W. Early Growth and Development of Slash Pine
MAHONEY, P. F.	MARKELOV, V. N.	Under Drought and Flooding,
Precoat Vacuum Filtration and Natural-Freeze Dewatering of Alum Sludge,	Radioactivity of Waters in Northeastern Part of	W73-03207 4A
W73-02965 5F	Atlantic Ocean,	MCNAB, W.
	W73-02710 5B	Early Growth and Development of Slash Pine
MAKER, H. J. Soil Associations and Land Classification for	MARLIER, G.	Under Drought and Flooding,
Irrigation, Lincoln County,	Studies on the Productivity of the Ponds of	W73-03207 4A
W73-02623 3F	Upper Belgium: The Biology of Limnephilus	MCNABB, C. G.
THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TW	lunatus Curtis (Trichoptera), W73-02689 2I	Public Water Supply Districts: Evaluation of a
MAKSIMOVICH, S. V. Flood Plain Vegetation of the Middle Regions	W 13-02009	New Institution,
of the Kerulen River (From Information of the	MARTINDALE, A.	W73-02918 6E
Joint Soviet-Mongolian Complex Biological Ex-	Desalination, W73-03005 3A	MCNEIL, M. F.
pedition of the Academy of Science of the	W73-03005	Sewage Treatment System,
USSR and the Academy of Science of the MP	Separator-Melter Unit for Desalination,	W73-02983 5D
R, (In Russian), W73-02882 21	W73-03012 3A	MEAULLE, A.
111111111111111111111111111111111111111	MARUTA, A.	Study of the Hydraulic Damping of the Vibra-
MALLATT, R. C.	Hydrodynamic Forces Acting on Sonic Oscilla-	tions of a Rod in the Turbulent Regime (Etude de l'amortissement hydraulique de la vibration
Process for Removing Contaminants from	tors in Sonic Transmissions (Forces	d'une baguette en regime turbulent),
Waste-Water, W73-03003	hydrodynamiques agissant sur les oscillateurs	W73-03054 8B
W13-03003	soniques prevus dans les transmissions soniques),	MEDVEDEV, A. G.
MALLETT, J.	W73-03056 8B	The Contents of Trace Elements in Eroded Sod
Periphyton and Phytobenthon as Indicators of		Podzolic Soils Formed on Morainic Deposits in
Water Quality, W73-02625 5B	MASSEY, B. C. Annual Compilation and Analysis of Hydrolog-	the Poozer'e (Lake Area) of Belorussia (In
W13-02023	ic Data for Urban Studies in the Dallas, Texas	Russian), W73-03214 2G
MALONEY, F. E.	Metropolitan Area, 1970,	
Missouri (Analysis of State Water Pollution	W73-02652 7C	MEEK, C. C.
Law and Comparison with Present and Proposed Tennessee Law),	MASTERTON, W. L.	Transport Processes of Particles in Dilute Suspensions in Turbulent Water Flow - Phase
W73-03217 6E	Effect of Dissolved Salts on Water Solubility	II,
W13-03217	of Lindane,	W73-02605 8B
North Carolina (Analysis of State's Water Pol-	W73-03185 5G	MEERS, R.
lution Law and Comparison with Present and Proposed Tennessee Law),	MATHRE, O. B.	Mercury Pollution of Golf Course Lakes,
W73-03218 6E	Process for Detoxifying Cyanide Waste	W73-02615 5B
	Waters,	MEGAHAN, W. F.
Texas (Analysis of State Water Pollution Law	W73-02989 5D	Erosional Consequences of Timber Harvesting:
and Comparison with Present and Proposed Tennessee Law),	MAWSON, C. A.	An Appraisal,
W73-03219 6E	Progress Report, Biology and Health Physics	W73-02957 2J
and the contract of the contract of the contract of	Division, Environmental Research Branch,	MEGREGIAN, S.
MAMAEV, M. M. Hydrochemical Regime of Ponds Fertilized	January 1972 to March 31, 1972, W73-02725 5C	What Water and Waste Water Parameters
with Complex Concentrated Forms of Fertil-	Harakan arasinin	Should We Measure,
izer,	MCADOO, G. D.	W73-02976 5A
W73-02728 8I	Development of Ground-Water Resources in the Orange County Area, Texas and Louisiana,	MEIDNER, H.
MANHEIM, M. L.	1963-71,	Effects of Water Stress on the Resistance to
Community Values: A Strategy for Project	W73-03139 4B	Uptake of Carbon Dioxide in Tobacco, W73-03193 3F
Planning,	MCCLAIN, E. P.	64
W73-02854 6B	Remote Sensing of Sea Ice from Earth Satel-	MEIER, P. M. A Branch-And-Bound Algorithm for Regional
MANOHAR, MAN SINGH	lites,	Water Quality Management,
Which Water Potential. Differences Between	W73-02645 7B	W73-03243 5G
Isopiestic Thermocouple Psychrometer Mea-	MCCOMAS, M. R.	MEIER, W. L. JR
surements of Intact and Excised Plant Materi-	Geology, Soils, and Hydrogeology of Volo Bog	Integrated Management of Quantity and Quali-
als, W73.03006	and Vicinity, Illinois.	ty of Urban Water Resources,
W73-03096 7B	W73-02657 2H	W73-02666 5G
MAPP, H. P. JR	MCEACHRAN, J. D.	MEKA, P. R.
An Economic Analysis of Water-Use Regula-	Autumn and Winter Occurrence of Decapod	Transport Processes of Particles in Dilute
tion in the Central Ogallala Formation,	Crustaceans in Chesapeake Bight, U.S.A.,	Suspensions in Turbulent Water Flow - Phase
W73-02892 4B	W73-02694 2L	II, W73-02605
MARCE, A.	MCKIM, J. M.	Chair Save House House Course Stable No.
Tritium in Investigation of Surface Hydrology.	Changes in the Blood of the Brown Bullhead	METCALF, T. G.
Experimental Determination of Coefficient of Runoff.	(Ictalurus nebulosus (Lesueur)) Following Short and Long Term Exposure to Copper (II),	Biologic Parameters in Water Transmission of Viruses,
W73-02713 5B	W73-02947 SC	W73-03173 5A

3F

MIHOK, E. A.

MIHOK, E. A.	MITTAL, S. P.
Limestone Neutralization of Dilute Acid Waste	Effect of Lateral Development of Prosopis ju-
Waters, W73-02994 5D	liflora DC. Roots on Agricultural Crops, W73-03101 3F
Neutralization of Ferrous Iron-Containing Acid	MIYAZAKI, M.
Wastes, W73-02993 5D	Determination of Total Mercury in Sludge (In Japanese),
	W73-02945 SA
MIKHAILOV, A. V. Hydrodynamic Pressure of Nonstationary Flow	Atlantia Ocean
in Canals Acting on Moored Ships,	MIZUNO, D.
W73-03033 8B	Pollution by Coliform Bacteria in Sea Water of Swimming Resorts: II (In Japanese),
MIKHAYLOVA, V. I.	W73-02928 5B
Water Balance of the Kara-Batkak Glacier	MONGELLI, F.
Basin (Vodnyy balans lednikovogo basseyna na primere lednika Kara-Batkak),	A Method for the Determination of the Ther-
W73-02635 2C	mal Properties of Soil Near the Surface,
	W73-03076 2G
MIKHEEV, V. P. Raising Salmon in the Inland Waters of Japan,	MONROE, E. S. JR
(In Russian),	Oxidative Waste Disposal,
W73-02899 8I	W73-03008 5D
A MARKET AND A SECOND AND AND AND AND AND AND AND AND AND A	MOORE II D
MILAN, D.	MOORE, H. R. The Effect of pH on Aerobic Sludge Digestion,
Study of Viscous Hydraulic Damping of Breathing Vibrations of a Cylindrical Shell in a	W73-02897 5D
Fluid at Rest (Etude de l'amortissement	A COCA CANCELLO COCA COCA COCA COCA COCA COCA COCA C
hydraulique visqueux des vibrations de respira-	MOORE, J. L.
tion d'une coque cylindrique dans un fluide au	A Methodology for Estimating the Benefits to
repos),	Irrigated Agriculture from Increased Accuracy in Seasonal Streamflow Forecasts.
W73-03053 8B	W73-03130 3F
MILHOUS, R. T.	and in least 5 for a limit and 5 for a contral and 12 for all and 14
Bed-Load Transport in Mountain Streams,	MOREAU, J. P.
W73-02893 2J	Study of the Pollution of the Lagoon at Tahiti
MILLER, B. R.	by Fecal Germs (In French), W73-03181 5B
Aggregate Returns from Water Resource	1 //
Development in Georgia, 1946 -1965,	MORGAN, E. L.
W73-02919 6B	Application of Biological Monitoring Systems
MILLER, E. F.	to Simulated Industrial Waste Discharge Situa- tions,
Desalting as a Source of Water Supply,	W73-02617 5C
W73-02861 3A	
MILLER, J. S.	MORGAN, J. M.
Gravitational and Dispersive Mixing in	Effect of Reservoir Drawdown on Optimal Operation,
Aquifers,	W73-03244 4A
W73-02791 2F	
MILLER, W.	MORGAN, P. R.
Economic Efficiency Vs. Environmental Quali-	Nucella lapillus (L.) As a Predator of Edible Cockles,
ty in Small Watershed Development,	W73-02703 2L
W73-02936 4D	MCARCO, C. D M. W. SECOLUL
MILLER, W. A. JR	MORGNER, A. W.
Experimental Investigation of Hydraulic	Water for Southern Nevada, W73-02848
Transients in River-Reservoir Systems, Phase	W73-02848
III, W73-02706 8B	MORITA, R. Y.
W 73-02700	Solubilization of inorganic phosphate by bac-
MILLINGTON, R. J.	teria isolated from upper Klamath Lake sedi-
Patterns of Water Uptake and Root Distribu-	ment, W73-02954 5C
tion of Soybeans (Glycine max.) in the Presence of a Water Table,	
W73-03114 3F	MOROZOVA, Z. V.
Charge Box of Lawrence and Control of Country and Control	Biological Background of High-Productive
MINTS, A. G.	Pastures and the Quality of the Feed (In Rus-
Herbivorous Fish in Ponds for Peat Production, (In Russian),	sian), W73-03180 3F
W73-02718 8I	HERES, R. S. MANDANCHI
Transport, Performs of Justicine St. Disposert	MORRISON, D. L.
MIRKIN, B. M.	Environmental Benefit-Cost Analysis for
Flood Plain Vegetation of the Middle Regions of the Kerulen River (From Information of the	Nuclear Power Generation, W73-02840 6B
Joint Soviet-Mongolian Complex Biological Ex-	LEESTHERSTEIL II. G. 24. L. MARCHE
pedition of the Academy of Science of the	MORROW, D. J.
USSR and the Academy of Science of the MP	Experimental Investigation of Effects of Un-
R, (In Russian), W73-02882	steady Flows on a Submerged Cylinder, W73-03019 8B
74004	ob

MORTON, F. C.	
Concentration of Viruses by Osm	
tration: A Preliminary Report on ment of a Model System,	the Develop-
W73-03176	5A
MORTON, H. L.	KRADACH
Morphological Response of Tv Varieties to 2,4,5-T and Picloram,	restriction [
W73-03080	4A
MOSER, H. Model Tests to Study Ground	water Flows
Using Radioisotopes and Dye Trac W73-02838	
Int Congress of the Lat.	OM TO S
MOTENKOVA, L. G. Feeding and Growth of Herbivore vae Raised in Ponds for Fry, (In R	
W73-02898	81
MOVCHAN, V. T.	Deputeling
Concerning Velocity Distributions	in Turbulent
Flow at Porous Surfaces, W73-03059	. 8B
2.3	TEALLAST
MUIR, K. S. Geology and Ground Water of the	e Pajaro Val-
ley Area, Santa Cruz and Montes California.	
W73-02653	4B
MUKHAMEDZHANOV, M. A.	
Mineral Waters Along the Eastern	
Caspian Lowland (Mineral's vostochnoy okrainy Prikaspiyskoy	nyye vody vpadiny),
W73-02813	human 4B
MUKHAMEDZHANOV, S. M.	
Prospects of Using Groundwaters	
tysh River Near Semipalatinsk in Economy (Perspektivy ispol'zova:	
nykh vod Semipalatinskogo P	
narodnom khozyaystve), W73-02812	bulcocon 4B
MUKHAMETSHINA, V. S.	
Flood Plain Vegetation of the Mi	iddle Regions
of the Kerulen River (From Infor-	
Joint Soviet-Mongolian Complex I	
pedition of the Academy of Scient USSR and the Academy of Scien	
R, (In Russian),	of an by B
11172 00000	- 41

MURPHY, C Location Teams in S W73-02910 MUSICK, J. Autumn a Crustacear W73-02694 MUSKAT, J. Aerating A W73-02984 MUYSKEN, Environm Power Pro W73-0277 MUZZAREI Methyl M Chromato W73-0317 NACCI, V. Groundwa W73-0262 NACE, R. L. Man and W73-0309 NAGAI, K. General F ysis by F W73-0285 NAMBIAR, Effect of liflora DC W73-0310 NARASIMI A New Complete W73-0260 NARDOZZ Water-Tr Now, W73-029 NARVER, A Survey on Two I W73-031

NEBOL'SI

Number

Reservoi Producti W73-031 NEKI, I. General ysis by cation, W73-028 NEKRASO The Role

tom-Fee the Dam W73-026

NELEPO, Radioac

W73-027

1115-02012	3 , 10	3562	OD
MURAKAMI, N.		deal.	
Determination of Total Merc	cury in	Sludge	(In
Japanese), W73-02945	100	120-12	5A
MURATOVA, T. A.		H, SE	
Nitrogen Compound Regime	in the	Water	and
Soil of Ponds, (In Russian), W73-02756		13.61	81

MURMANN, R. K.	VA VE 2017
The Preparation as	d Oxidative Properties
Ferrate Ion (FeO42-). Studies Directed Towar
Its Use as a Water I	urifying Agent,
W73-02608	THE STATE OF

MURPHY, C. R. JR	NEMERYUK, G. E.	O'LEARY, J. W.
Location and Equipment for Oil Recovery	Salt Migration into the Atmosphere During	Response of Osmotically Stressed Plants to
Teams in San Diego, W73-02910 5G	Transpiration, W73-03206 2D	Growth Regulations, W73-03104 3C
Military vodami Adia	Mr. 1942 Mary	The Well of the State of the St
MUSICK, J. A. Autumn and Winter Occurrence of Decapod	NEOGY, B. N. Brink Depth for Trapezoidal Broad-Crested	O'LEARY, T. V.
Crustaceans in Chesapeake Bight, U.S.A.,	Wair	The Coming Technical Revolution in Meter Reading,
W73-02694 2L	W73-02788 8B	W73-02863 7B
14014	NEWCOMB B ID	2.7.1020
MUSKAT, J. Acrating Apparatus,	NEWCOME, R. JR Water for Industrial Development in Copiah	OLIVE, P.
W73-02984 . 5D	and Simpson Counties, Mississippi,	Tritium in Investigation of Surface Hydrology. Experimental Determination of Coefficient of
and the substitution of th	W73-02651 3E	Runoff,
MUYSKEN, M.	(Amar) all microst about 150	W73-02713 5B
Environmental Effects Specific to Nuclear Power Production.	NEWELL, R. C. The Influence of Thermal Acclimation on the	OLIVERAD III D
W73-02774 5C	Relation Between Oxygen Consumption and	OLMSTEAD, W. R. Salt Injury to Plants with Special Reference to
A second of the second of the second of the second of	Temperature in Littorina littorea (L.) and Myti-	Cations Versus Anions and Ion Activities.
MUZZARELLI, R. A. A.	lus edulis L.,	W73-03077 3C
Methyl Mercury Acetate From Waters by	W73-02760 5C	A THE STATE OF THE
Chromatography on Chelating Polymers, W73-03179 5A	NEWTON, J. P.	OLMSTED, L. M.
W/3-031/3	Improved River Basin Utilization Through	Transmission Goals: Maximum Rating With Minimum Environmental Impact,
NACCI, V. A.	Systems Analysis,	W73-02843 8C
Groundwater Flow in Partially Saturated Soils,	W73-02665 6A	
W73-02624 5B	NIKITIN, L. K.	OMMANNEY, C. S. L.
NACE, R. L.	Approximate Calculation of a Thermally	Glacier Surveys by District Personnel of the Water Survey of Canada: 1. The Victoria Glaci-
Man and Water: A Lesson in History,	Stratified Turbulent Boundary Layer in a Re-	er,
W73-03090 3F	gion Downstream. A Sharp Change in the	W73-02648 2C
NAGAI, K.	Roughness of the Surface at Which Flow Takes	
General Purpose Program of Plane Stress Anal-	Place, W73-03058 8B	ONIPCHENKO, G. F. Hydrodynamic Pressure of Nonstationary Flow
ysis by Finite Element Method, and its Appli-	W /3-03036	in Canals Acting on Moored Ships,
cation,	NISHIKAWA, KIN-ICHI	W73-03033 8B
W73-02852 8A	Studies on the Physiological Nature of Alfalfa	1000 000
NAMBIAR, K. T. N.	Plants: 9. Effect of soil Moisture on the Summer Growth of Alfalfa (In Japanese),	OPHIR, I.
Effect of Lateral Development of Prosopis ju-	W73-03200 3F	Effects of Streptomycin on the Ultrastructure of Plastids in Euglena,
liflora DC. Roots on Agricultural Crops,	T. J.	W73-02972 5C
W73-03101 3F	NORDLIN, E. F.	THE ARMST AND THE PARTY OF THE
NARASIMHAN, K. A.	Slotted Corrugated Metal Pipe Drains, W73-02659 8A	ORPHAN, V. J.
A New Approach for Water Reclamation -	W /3-02039	Application of CF252 to the Detection of Heavy Metals for Pollution Control,
Complete Treatment of Waste Water by	NORRIS, S. E.	W73-02738 5A
Physico-Chemical Processes, W73-02607 5D	The Use of Gamma Logs in Determining the	The same of the sa
W73-02607 5D	Character of Unconsolidated Sediments and Well Construction Features,	OSEID, D. M.
NARDOZZI, A. D.	W73-02802 4B	Effects of Hydrogen Sulfide on Fish Eggs and
Water-Treatment-Plant Waste DisposalAction	78000000,000	Fry, W73-03164 SC
Now,	NORTH, G. W.	- back glebyic, more I morell segments
W73-02964 5F	Remote Sensing of Environmental Pollution, W73-03131 5A	OSHLAKOV, G. G.
NARVER, D. W.	W/3-03131	Occurrence of Groundwater in the Piedmont
A Survey of Some Possible Effects of Logging	NOVAK, M.	Alluvial Plain on the Northern Slope of Dzun- garian Ala Tau (Formirovaniye podzemnykh
on Two Eastern Vancouver Island Streams,	Problems Concerning Solution of Steady and	vod predgornogo shleyfa severnogo sklona Dz-
W73-03160 4C	Unsteady Groundwater Flow by Statistical Methods,	hungarskogo Alatau),
NEBOL'SINA, T. K.	W73-02826 2G	W73-02816 4B
Number of Commercial Fish in the Volgograd	NONEGRADIA N. N.	OSIPOV, V. V.
Reservoir and Measures for Increasing Their Productivity, (In Russian),	NOVICHKOVA, N. V. Origin of Manganese Nodules of the Pacific	Water Consumption in the Growth of Organic
W73-03172 8I	Ocean From Radioisotope Data,	Substances in Certain Biocoenoses in the
Beginner of Democratic Transactions	W73-02752 5B	Southern Taiga, (In Russian),
NEKI, L.	NYLUND, R. E.	W73-02688 21
General Purpose Program of Plane Stress Anal- vsis by Finite Element Method, and its Appli-	The Influence of Mist Irrigation on the Potato	OSTER, E. A.
cation,	I. Micro-Environment and Leaf Water Rela-	Flood Profiles in the Umpqua River Basin,
W73-02852 8A	tions,	Oregon, Part I,
NEKRASOVA, M. Y.	W73-02888 3F	W73-02660 7C
The Role of Zoobenthos in the Feeding of Bot-	OAKLEY, W. T.	O'TOOLE, J.
tom-Feeding Fish and the Food Supply After	Water for Industrial Development in Copiah	Vegetable Production Under Plastic on the
the Damming of the Don (In Russian),	and Simpson Counties, Mississippi,	Desert Seacoast of Abu Dhabi,
W73-02677 2L	W73-02651 3E	W73-03110 3F
NELEPO, B. A.	O'BRIEN, W. J.	OVERTON, W. S.
Radioactivity of Waters in Northeastern Part of	Modeling Discharge and Conservative Water	Environmental Planning and Ecological Possi-
Atlantic Ocean,	Quality in the Lower Kansas River Basin,	bilities,
W73-02710 5B	W73-02658 4A	W73-03184 6G

POLLARD,

The Biolo

maily Cat Maculatu W73-0285

The Biolo mally Cat

Maculatu matic Rel W73-028

POLYAKO

Contents Soil Air i

an Polest W73-030

PORTERF

POULIN, C A Rapid

W73-032

W73-031

PRAJAPA"

Effect o liflora D

W73-031 PRAPROT

The Adi

national W73-032

PRASAD, Effects

Mango (

W73-026 PRESTON Fine St

Chactor

Develop W73-02

PRICE, C A Com ministra Water-l

W73-02 PRISCO,

> Respon Growth

W73-03

PROSKU

PRYAZH

Develo Taking Problem W73-0

Oxygen of the gy, (In W73-02

POWELL, An Effe tion by I

Effects (Gossypi Cell Mic W73-030

-	-	
OW	ENS	 ъ.

OWENS, L. B. Nitrate Transformations in Surface Waters; I. A Study of Various Factors Affecting the Rates of Denitrification and Immobilization in Surface Waters, and II. Characterization of the Surface Waters in the Wabash River and Three Farm Ponds, W73-03191 5B PACHA, R. E. Solubilization of inorganic phosphate by bacteria isolated from upper Klamath Lake sediment, W73-02954 5C PAGE, B. G. Slotted Corrugated Metal Pipe Drains, W73-02659 8A	PATTON, A. J. Turbulent Thermal Diffusion of a Slot Jet Flowing into a Moving Stream, W73-02895 PAZOUREK, J. Water Loss From Leaves as Affected by Previous Exposure in an Atmosphere Saturated with Water Vapor, W73-02925 PENKA, M. A Contribution to the Study of Transpiration in Woody Species (In Czech.), W73-02950 PENTLAND, R. L. Great Lakes Simulation ModelA Decision Aid, W73-03234 2H	PFANNKUCH, HO. On the Correlation of Electrical Conductivity Properties of Porous Systems with Viscous Flow Transport Coefficients, W73-02822 2F PHILIP, J. R. Hydrostatics and Hydrodynamics in Swelling Media, W73-02837 2G PICKETT, T. E. The Availability of Ground Water in Eastern Sussex County, Delaware, W73-02805 4B The Availability of Ground Water in Kent County, Delaware, With Special Reference to the Dover Area, W73-02806 4B
Investigations on the Development of Some Or- namental Wood Species on Eroded Saline Soil of the Mouth of Jijia-Bahlui Depression, (In Rumanian), W73-02680 3C	PEQUEGNAT, W. E. The Impact of Water Development on Ecology of the Gulf of Mexico, W73-03070 5B	The Availability of Ground Water in New Cas- tle County, Delaware, W73-02785 4B PIERSALL, C. H. JR
PALEN, J. W. Fouling: The Major Unresolved Problem in Heat Transfer, W73-02775 8B	PEREVERZEV, A. M. Concerning Velocity Distributions in Turbulent Flow at Porous Surfaces, W73-03059 8B	Cost Analysis of Optional Methods of Ship- board Waste Disposal, W73-02916 5E
PALTA, J. P. Effect of an Asphalt Barrier on Water Redis- tribution after Infiltration in Sandy Soils, W73-03189 2G	PERSSON, A. Effects of Locomoter Restraint and of Anaesthesia with Urethane or MS-222 on the Reactions of Young Salmon (Salmo salahrL.) to Environmental Fluctuations of pH and Carbon	Project Fog Drops. Part 1: Investigations of Warm Fog Properties, W73-02782
PAN, P. T. Biogrid Unit and Method, W73-03001 5D	Dioxide Tension, W73-03169 5C PETERS, D. B.	PINGRY, D. Cost Allocation for A Regional Pollution Treatment System, W73-02937 5G
PANGBORN, R. M. Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, W73-02779 5F	Patterns of Water Uptake and Root Distribu- tion of Soybeans (Glycine max.) in the Presence of a Water Table, W73-03114	PIZZO, J. J. Sewage Treatment System, W73-02983 5D
PARKER, D. G. Removal of Phosphate from Waste Water, W73-02990 5D	PETERSON, R. S. The Vertical Movement of Oil in Seawater and the Aging of Oil Slicks, W73-02904 5G	PLATFORD, R. F. Isopiestic Determination of Solubilities in Mixed Salt Solutions. Two Salt Systems, W73-03063 2K
PARKER, J. C. Commercial Shrimp FarmingNearing Reality, W73-02932 3E PARR, B. R.	PETINOVA, L. P. Determination of Optimal Proportions of Nitrogen and Phosphorus Contents Used for Pond Fertilization, (In Russian), W73-02681 81	PLEBIN, R. RU106 Distribution in a Reduced Model Simulating River Banks; Some Hydrodynamic and Kinetic Aspects of Its Adsorption on Sediments (Repartition Du RU106 Dans Un Modele
Desalination, W73-03005 3A Separator-Melter Unit for Desalination, W73-03012 3A	PETRENKO, L. V. Raising Salmon in the Inland Waters of Japan, (In Russian), W73-02899 81	Reduit Simulant Les Berges D'Une Rivi ere), W73-02724 5B PLESSNER, O. E. Sodium Export From Bean Leaves as Affected
PARRISH, L. P. Multi-Disciplinary Study of Water Quality Relationships: A Case Study of Yaquina Bay, Oregon, W73-02921 5C	PETRIE, E. M. Porous Support Tubes for Reverse Osmosis, W73-03009 3A PETROPOULOS, D. P.	by the Mode of Application, W73-03073 21 PLITMAN, S. I. Experimental Substantiation of the Maximal Permissible Content of Pentacrythritol and
PARTENSCKY, H-W. Theoretical Study on Flap Gate Oscillation, W73-03044 8B	A Computer Simulation Model for Flood Plain Development, Part 1: Land Use Planning and Benefit Evaluation, W73-02944 4A	Xylitol in Water Bodies, (In Russian), W73-03159 PLUENNEKE, R. H. The Influence of Low Substrate Sodium Levels
PASVEER, A. Activated Sludge Processing, W73-02981 5D PATTERSON, C. C.	PETROV, N. D. Water Resources of the Uspenskiy Mining District and a Technical and Economic Justification of Their Use (Vodnyye resursy Uspenskogo rudnogo poyasa i tekhniko-	Upon the Free Amino Acid Content of Cotton Leaves, W73-03089 POGGE, E. C.
Municipal and Industrial Waste with Limited Water Resources, W73-03127 5F	ekonomicheskoye obosnovaniye ikh ispol'- zovaniya), W73-02814	Modeling Discharge and Conservative Water Quality in the Lower Kansas River Basin, W73-02658

POLLARD, D. A.	PUPKE, J. L.	REED, T. G.
The Biology of a Landlocked Form of the Nor-	Antibodies Against Human Enteric Bacteria in	Experimental Investigation of Effects of Un-
mally Catadromous Salmoniform Fish Galaxias		steady Flows on a Submerged Cylinder,
Maculatus (Jenyns): I. Life Cycle and Origin,	Leseuer) from Contaminated Waters,	W73-03019 8B
W73-02855 21	W73-02975 5C	Service and the service of the servi
	MARTINIA NATURAL A.	REEVES, R. D.
The Biology of a Landlocked Form of the Nor-	PURVIS, M. R. JR	Chemical and Bacteriological Quality of Water
mally Catadromous Salmoniform Fish Galaxias	Removal of Phosphates from Sewage Effluent,	at Selected Sites in the San Antonio Area, Tex-
	W73-03000 5D	as, August 1968-April 1972,
Maculatus (Jenyns): II. Morphology and Syste-	W 13-03000	W73-02808 5B
matic Relationships,	BVATT D D	W 15-02000
W73-02856 2I	PYATT, E. E.	REICOSKY, D. C.
	Benefits of Flow Augmentation for Water	
POLYAKOVA, O. Y.	Quality Control,	Patterns of Water Uptake and Root Distribu-
Contents of Oxygen in Soil Water and CO2 in	W73-03242 5G	tion of Soybeans (Glycine max.) in the
		Presence of a Water Table,
Soil Air in Forest Bogs of the Central Ukraini-	PYE, V. I.	W73-03114 3F
an Poleste (In Ukranian),	The Influence of Thermal Acclimation on the	
W73-03091 4A		REISEN, W. K.
	Relation Between Oxygen Consumption and	Some Ecological Notes on Lotic Dipteran
PORTERFIELD, M. P.	Temperature in Littorina littorea (L.) and Myti-	Emergence in Prater's Creek, South Carolina,
Effects of Salt Treatments of Cotton Plants	lus edulis L.,	W73-03162 5C
(Gossypium hirsutum L.) on Leaf Mesophyll	W73-02760 5C	W 73-03102 3C
		BPHOC B P
Cell Microstructure,	RABCHEVSKY, G. A.	REUSS, R. F.
W73-03081 3C	Hydrologic Conditions Viewed by the Nimbus	Internal Piping and Shear Deformation Victor
		Braunig Dam - San Antonio, Texas,
POULIN, C.	Meteorological Satellites,	W73-03250 8D
A Rapid Grain Size Analysis Method,	W73-03135 7B	pur Manual and sures as her
make the control of t		REYNOLDS, P. J.
W73-03249 8D	RADHA KRISHNAN, K. P.	Systems Approach to Regional Water Use and
	Compilation of Water Quality Data and	
POWELL, R. D.	Parameters from Kansas Rivers and Streams,	Demand,
An Effect of Water Stress on Ethylene Produc-		W73-03238 6A
tion by Intact Cotton Petioles,	W73-02973 5A	
and the same of th		RIBAK, R.
W73-03112 3F	RAHMAN, M. A.	A New Data Base for Syntax-Directed Pattern
	Damage to Karnafuli Dam Spillway,	Analysis and Recognition,
PRAJAPATI, M. C.	W73-02787 8B	W73-02885 7C
Effect of Lateral Development of Prosopis ju-		1173 02005
liflora DC. Roots on Agricultural Crops,	RANDALL, C. W.	RICE, R. M.
		Erosional Consequences of Timber Harvesting:
W73-03101 3F	The Effect of pH on Aerobic Sludge Digestion,	The state of the s
to knowled that the case in the last warm in the	W73-02897 5D	An Appraisal,
PRAPROTNIK, W.		W73-02957 2J
The Adria (Monfalcone) - Danube Basin Inter-	Optimal Conditioning Procedures for Waste	
national Waterway.	Activated Sludge Disposal,	RIDLEY, J. E.
	W73-02616 5D	Control of Thermal Stratification in Thames
W73-03230 4A	W/3-02016	Valley Reservoirs,
Water Branch of the University Mislandia	210 1 2	W73-02778 5B
PRASAD, A.	RAO, A. R.	W 13-02116
Effects of Irrigation Methods on Growth of	Some Extensions of Linear Systems Analysis	Thermal Stratification and Thermocline Control
Mango (Mangifera indica L.) Plants,	in Hydrology,	
W73-02698 3F	W73-02662 2A	in Storage Reservoirs,
W.15-02070		W73-02777 5B
PROPERTY B. D.	RAPHAEL, D. L.	
PRESTON, R. D.		RILEY, J. P.
Fine Structure of Swarmers of Cladophora and	A Water Supply-Demand Analysis in Clinton	A Self-Verifying Hybrid Computer Model of
Chaetomorpha. III. Wall Synthesis and	County, Pennsylvania: A Study in Economic	River-Basin Hydrology,
Development,	Hydrology,	
	W73-02610 6D	W73-03183 2A
W73-02966 5C		DAMPER D. D.
12/0/6/11	RASMUSSEN, G. P.	RITTER, R. B.
PRICE, C. D.	Anaerobic Treatment of Starch Wastewaters,	Fouling: The Major Unresolved Problem in
A Comparison of Public and Resource Ad-		Heat Transfer,
ministrator Visual Perceptions of an Outdoor	W73-02619 5D	W73-02775 8B
Water-Based Recreation Area,		373.050
	RAUERT, W.	ROACH, J. T.
W73-02612 6B	Model Tests to Study Groundwater Flows	A Land-Use Classification System for Use
people of grant of best best to married	Using Radioisotopes and Dve Tracers,	With Remote-Sensor Data,
PRISCO, J. T.	W73-02838 2F	
Response of Osmotically Stressed Plants to	11.3-02030 ZP	W73-02649 7B
Growth Regulations,	RAWSON, J.	
		ROBERTS, D. G.
W73-03104 3C	Chemical and Bacteriological Quality of Water	Slumping on the Eastern Margin of the Rockall
BRACKURINA P C	at Selected Sites in the San Antonio Area, Tex-	Bank, North Atlantic Ocean,
PROSKURINA, E. S.	as, August 1968-April 1972,	W73-02799 2J
Oxygen Consumption of Larvae and Juveniles	W73-02808 5B	TARREST CONTRACTOR
of the Carp Family in Relation to Their Ecolo-	20 miles 20	ROBINSON, D. G.
gy, (In Russian),	REDSHAW, A. J.	Fine Structure of Swarmers of Cladophora and
W73-02682 81	Effects of Water Stress on the Resistance to	
entransity of the second of the second		Chaetomorpha. III. Wall Synthesis and
BRYATHINGVAVA V.C	Uptake of Carbon Dioxide in Tobacco,	Development,
PRYAZHINSKAYA, V. G.	W73-03193 3F	W73-02966 5C
Development of Water Resources of a Basin	23/13/15 B. F.	313/485-A-M
Taking Economic Aspects into Account: Pecu-	REED, D. W.	ROBINSON, D. W.
liarities of Investigation of Practical Irrigation	Gromet IIRainfall Augmentation in the Philip-	The Response of Gooseberries to Non-Tillage
Problems,	pine Islands,	Systems of Management,
	W73-03149 3B	W73-02699 3F
W73-03226 3F	# /3-03147 3B	

SHEPPARD Distributi Tabanida W73-0315

Monitoria mont Prezhimon ravninaki W73-028

SHIH, C. C Experime steady F W73-030

SHIH, C. S Integrate ty of Uri W73-026

Systems of Water W73-032

SHIPLEY, Vertical ty Meas W73-02 SHLYGIN Ground dations Econon zovaniy 1976 po W73-02 Monito mont rezhim ravnina W73-02

> SHUKLA Germin Related of Soil W73-0

> SIDES, C Clay S W73-0 SIECKN Aerati W73-0 SIGNIE Force in a V W73-4 SILMA Effect of Pla W73-SIMMO Wate Manu W73-SINGH Effe Man W73

5B

ROENKO,	-	4.0

ROENKO, O. V. Number of Commercial Fish in the Volgograd	SAKAI, K. Determination of Total Mercury in Sludge (In	SEETHARAMAN, S. Acration of Weirs,
Reservoir and Measures for Increasing Their Productivity, (In Russian),	Japanese), W73-02945 5A	W73-03142 8B
W73-03172 81	SAKTHIVADIVEL, R.	SEIDEL, K. W. Drought Resistance and Internal Water Balance
ROGERS, C.	Aeration of Weirs,	of Oak Seedlings,
Project Fog Drops. Part 1: Investigations of Warm Fog Properties.	W73-03142 8B	W73-03199 2D
W73-02782 2B	SALEHI, K. Transport Processes of Particles in Dilute	SELCUK, M. K. Use of Digital Computers for the Heat and
ROMANENKO, V. A.	Suspensions in Turbulent Water Flow - Phase II,	Mass Transfer Analyses of Controlled Environ- ment Greenhouses,
Method for Determining Number of Bacteria in Ooze Deposits of Water Reservoirs (In Rus-	W73-02605 8B	W73-03082 2D
sian), W73-03115 5A	SALMAN, H. A. Development of Analytical Procedures for	SENIN, Y. M. Uranium Concentration in Recent Ocean Sedi-
ROMANENKO, V. I.	Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From	ments in Zones of Rising Currents, W73-02748 5B
Method for Determining Number of Bacteria in Ooze Deposits of Water Reservoirs (In Rus-	Storage Reservoirs, W73-02844 5A	SEPPOVAARA, O.
sian), W73-03115 5A	SALOMONSON, V. V.	Effluent and Water Quality Control of a Synthetic Fiber Pulp Mill (Abwasser Und
ROSING, J.	Nimbus 3 and 4 Observations of Snow Cover	Gewaesserschutz Einer Kunstfaserzelistof-
A Computer Simulation Model for Flood Plain	and Other Hydrological Features in the Western Himalayas,	fabrik), W73-03157 5D
Development, Part 1: Land Use Planning and Benefit Evaluation,	W73-03134 7B	SEUS, G. J.
W73-02944 ~ 4A	SAMPSON, R. N.	On the Optimization of the Design of Storage
ROTHACHER, J. S.	Porous Support Tubes for Reverse Osmosis, W73-03009	Areas at River Dams, W73-03239 4A
Erosional Consequences of Timber Harvesting: An Appraisal,	W. State V.	SEVER, C. W.
W73-02957 2J	SANDERS, D. C. The Influence of Mist Irrigation on the Potato I. Micro-Environment and Leaf Water Rela-	Ground-Water Resources and Geology of Cook County, Georgia,
ROUTSON, R. C. Methods for the Characterization of Suspended	tions,	W73-02807 4B
Sediment and Selected Applications for the	W73-02888 3F	SHADRINA, N. I.
Acquired Data, W73-02977 5B	SANDERS, G. A. Shipboard Control of Wastes,	Dynamics of Nutrients in Relation to the Hydrological Regime of Soils in Bog Forests of
ROZENBURG, E. R.	W73-02902 5G	the Southern Taiga in the Transurals (In Russian),
The Composition and Distribution of the Fish Fauna of the Navasota River.	SANDMO, A. Discount Rates for Public Investment Under	W73-03208 2G
W73-02613 8I	Uncertainty, W73-02942 6B	SHAPIRO, S. M. Water Resources of the Uspenskiy Mining Dis-
RUBINSHTEIN, M. I.	And the State of the last of t	trict and a Technical and Economic Justifica-
Condensation Processes in Non-Irrigated Soils (In Russian),	SANIN, N. A. Raising Salmon in the Inland Waters of Japan,	tion of Their Use (Vodnyye resursy Uspen- skogo rudnogo poyasa i tekhniko-
W73-03211 2G	(In Russian), W73-02899 81	ekonomicheskoye obosnovaniye ikh ispol'-
RUMER, R. R. JR	The second secon	zovaniya), W73-02814 4B
On the Derivation of a Convective-Dispersion Equation by Spatial Averaging,	SCHATTENBERG, J. W. Internal Piping and Shear Deformation Victor	SHAW, T. L.
W73-02832 2F	Braunig Dam - San Antonio, Texas, W73-03250 8D	Flow-Induced Dynamic Pressures on Square- Section Cylinders,
RUSH, F. E.	and the second s	W73-03022 8B
Bathymetric Reconnaissance of Big and Little Washoe Lakes, Washoe County, Nevada,	SCHEIDEGGER, A. E. Thermodynamic Analogy of Mass Transport	Wake Dynamics of Two-Dimensional Struc-
W73-03138 7C	Processes in Porous Media, W73-02819 2F	tures in Confined Flows, W73-03024 8B
Hydrologic Reconnaissance of Big and Little	SCHULTZ, V.	SHCHERBINA, A. K.
Soda Lakes, Churchill County, Nevada, W73-03137 7C	Ecological Techniques Utilizing Radionuclides and Ionizing Radiation. A Selected Bibliog-	Distribution of Red Spot Disease in Waters Used for Fish Breeding (In Russian),
RUSSELL, T. W. F.	raphy,	W73-03109 5C
Mass Transfer and Chemical Reaction in Two- Phase Flow.	Table State of the American of the House Co.	SHCHUKINA, A. A.
W73-02875 5D	SCHULZ, E. F. An Application of Multi-variate Analysis in	Fish of the Kuibyshev Reservoir (In Russian), W73-03083
RYZHOVA, L. N.	Hydrology, W73-02873 2E	SHEININ, L. S.
Some Blood Characteristics in Black Baikal Grayling Thymallus articus Baicalensis Dyb.	SCHUTZENHOFER, L. A.	Hydrodynamic Forces Due to Nonstationary Oscillations of Cylindrical Shells in a Fluid
With Reference to the Estimation of the Grow-	Experimental Investigation of Effects of Un-	Medium with Deformations of the Cross-Sec-
ing Conditions (In Russian), W73-03111	steady Flows on a Submerged Cylinder, W73-03019 8B	tion Taken into Account, W73-03047
SAFIR, G. R.	SEAGRAVES, J. A.	SHEN, H. W.
Nutrient Status and Mycorrhizal Enhancement	Surcharges and Stream Charges as Economic	Dispersion of Contaminated Bed-Load Parti-
of Water Transport in Soybean, W73-03087 3F	Incentives, W73-03190 5G	cles, W73-02650 5B

SHEPPARD, D.C.	SINGH, CHOKHEY	SMITH, R. L.
Distribution and Seasonal Occurrence of	Performance of Rainfed American Cotton	Modeling Discharge and Conservative Water
Tabanidae along a Transect of South Carolina,	(Gossypium hirsutum L.) under Three Sowing	Quality in the Lower Kansas River Basin,
W73-03156 5B	Times, Three Row Spacings and Three	W73-02658 4A
SHESTAKOV, F. V.	Nitrogen Levels in Nimar Tract of Madhya	SMITH, W. E.
Monitoring Groundwater Reservoirs in Pied-	Pradesh, W73-03201 3F	Culture, Reproduction, and Temperature
mont Plains of Tien Shan (Upravleniye	W 75-03201	Tolerance of Pontoporeia affinis in the Labora-
rezhimom podzemnykh vod na predgornykh	SINITSINA, N. I.	tory,
ravninakh Tyan' -Shanya),	Pepper Yield As Affected by	W73-03168 5C
W73-02815 4B	Hydrometeorological Factors (In Russian),	SNAVET N E S TO
SHIH, C. C.	W73-02674 3F	SNAVELY, E. S. JR Removal of Dissolved Oxygen from Water,
Experimental Investigation of Effects of Un-	SIONIT, N.	W73-02988 5D
steady Flows on a Submerged Cylinder,	Salt Tolerance of Safflower Varieties	1175-0250
W73-03019 8B	(Carthamus tinctorius L.) During Germination,	SOBOSLAI, J. W.
AND DESCRIPTION OF PERSONS AND ADDRESS OF THE PERSON OF TH	W73-03088 3C	Production of Geosmin and 2-Exo-Hydroxy-2-
SHIH , С. S.	OMURDAY D	Methylbornane by Streptomyces odorifer,
Integrated Management of Quantity and Quali-	SIWERTZ, E. Tritium in Investigation of Surface Hydrology.	W73-02949 5A
ty of Urban Water Resources, W73-02666 5G	Experimental Determination of Coefficient of	SOBSEY, M. D.
W 73-02000 5G	Runoff,	Laboratory Studies on the Survival of
Systems Approaches to Microscale Problems	W73-02713 5B	Poliovirus in Algal-Bacterial Wastewater Treat-
of Water Pollution Control,		ment Systems,
W73-03223 5G	SKINNER, W. F.	W73-03178 5D
Photograph is the first popular to the party of the party	The Interaction of Sewage, Thermal, and Acid	SOKOLSKAYA, N. L.
SHIPLEY, E. L.	Mine Water Loadings on the Growth of Chlorella,	New Data on the Fauna of Naididae
Vertical and Horizontal Laboratory Permeabili- ty Measurements in Clay Soils,	W73-02974 5C	(Oligochaeta) of Lake Baikal,
W73-02833 2G	413-02514	W73-03016 2H
113-02033	SMALL, L. F.	
SHLYGINA, V. F.	Diel Periodicity of Chlorophyll a Concentration	SOKULOSKI, A.
Groundwaters of Kazakhstan and Recommen-	in Oregon Coastal Waters,	Multi-Disciplinary Study of Water Quality
dations Regarding Their Use in the National	W73-02970 5C	Relationships: A Case Study of Yaquina Bay, Oregon.
Economy for 1976-80 (Podzemnyye vody	SMEETS, J. G. P. M.	TV72 02021
Kazakhstana i rekomendatsii po ikh ispol'-	Symposium on Radioecology Applied to the	W 13-02921
zovaniyu v narodnom khozyaystve v period s	Protection of Man and His Environment,	SOLBE, J. F. DE L. G.
1976 po 1980 g.),	W73-02722 5B	An Approach to the Problem of Pollution and
W73-02810 4B		Fisheries,
Monitoring Groundwater Reservoirs in Pied-	SMITH, A. W.	W73-03163 5C
mont Plains of Tien Shan (Upravleniye	Ecological River Basin Management,	SOUTH, W. D.
rezhimom podzemnykh vod na predgornykh	W73-03092 6E	Relating Kraft Waste Stream Properties to
ravninakh Tyan' -Shanya),	SMITH, E. T.	Biochemical Oxygen Demand,
W73-02815 4B	Mathematical Models for Regional Economic	W73-02940 5B
SHUKLA, S. P.	and Waste Load Projection,	COLORO D D
Germination Behaviour of a Weed and Three	W73-02920 5B	SPARKS, R. E. Application of Biological Monitoring Systems
Related Crop Plants Under Various Conditions	SMITH, G. L.	to Simulated Industrial Waste Discharge Situa-
of Soil Water Content and Temperature,	Experimental Investigation of Converging	tions.
W73-02673 3F	Overland Flow,	W73-02617 5C
MINIO C B	W73-03018 2E	
SIDES, G. R.		SPARROW, E. M.
The Flow of Air and Water in Partly Saturated Clay Soil,	SMITH, G. S.	Observations and Other Characteristics of
W73-02834 2G	Bioassays of Quality in Water Resources of	Thermals, W73-02757 8B
11.5 02007	Major Importance to New Mexico, W73-02876 SC	W73-02757 8B
SIECKMANN, J.	W 73-02876	ST-AMAND, P.
Aerating Apparatus,	SMITH, J.	Gromet II-Rainfall Augmentation in the Philip-
W73-02984 5D	Concentration of Viruses by Osmotic Ultrafil-	pine Islands,
SIGNIER. A.	tration: A Preliminary Report on the Develop-	W73-03149 3B
Forces Due to Cylinders Falling Through Water	ment of a Model System,	Project Foggy Cloud III, Phase 1,
in a Vertical Tube,	W73-03176 5A	W73-03145 3B
W73-03021 8B	SMITH, L. L.	
	Effects of Hydrogen Sulfide on Fish Eggs and	STAMBERG, J. B.
SILMAN, R.	Fry,	Removal of Nitrogen and Phosphorus from
Effects of Streptomycin on the Ultrastructure	W73-03164 5C	Waste Waters,
of Plastids in Euglena, W73-02972 5C	SMITH, M. J.	W73-03002 5D
W73-02972 5C	Desalination,	STARK, K. P.
SIMMONS, M.	W73-03005 3A	A Numerical Study of the Nonlinear Laminar
Water and Our Future: An Urban Planning		Regime of Flow in an Idealised Porous Medi-
Manual for Local Officials,	Separator-Melter Unit for Desalination,	um,
W73-02872 6B	W73-03012 3A	W73-02825 2F
SINGH, A. R.	SMITH, R. E.	STEARN, H. M.
Effects of Irrigation Methods on Growth of	Experimental Investigation of Converging	Cleaning Water Mains With Foam Plugs-Ex-
Mango (Mangifera indica L.) Plants,	Overland Flow,	perience at Washington, D. C.,
W73-02698 3F	W73-03018 2E	W73-02862 5G

THISSEN, The Bre Ponds, W73-027

THOMAN Systems ment, W73-025

THOMAS Effect of tion Pla W73-02

THOMAS
The Mi
the Sys
provem
W73-03

A Syst Phosph from C W73-02

THORBO Desalti Ion Ex W73-0

Determination Nitrog Pond 1 W73-0

TIMON Relati sity i Come W73-

TLEKE

Prosp tysh Econ nykh narod W73-

TOEBI The Bluff W73

TOMP Effe Nitr Sats W73

Dyn cum Wat riga W7:

TROS Env

TRYA Eff Mi: W7

-51	EEL,	•	₽.

STEEL, J. A. P.	SUNADA, D. K.	TAMARIN, A. E.
Control of Thermal Stratification in Thames	Boundary Effects in Desaturation of Porous	Some Data on the Respiration of Salmon Ju-
The second section of the second section is a second section of the second section of the second section is a second section of the second section sec	THE PROPERTY OF STREET ASSESSMENT ASSESSMENT OF THE PROPERTY O	veniles in Relation to the Biotechnique of
Valley Reservoirs,	Media,	
W73-02778 5B	W73-03064 2G	Breeding, (In Russian),
Total Carried the Advances of the Advances		W73-02683 8I
STEPHENS, B. R.	SUNADA, T.	-bold all long to the firm of the total bases
Apparatus for the Distillation of Sea Water,	Process of Purifying Water by Irradiating It,	TANITO, K.
W73-02985 3A	W73-02982 5D	Process of Purifying Water by Irradiating It,
make the treat has believed as	11.7 42.702	W73-02982 5D
STERLING, C.	SUNDSTROM, R. W.	STATE M. A. PROPERTY
		TANNIAN, F.
	The Availability of Ground Water in Eastern	Water Resources Management in Delaware,
W73-02850 6G	Sussex County, Delaware,	
3/80/10/	W73-02805 4B	W73-02622 6B
STERNBERG, R. W.		TAUB, S. H.
Synoptic Measurements of Currents and Sedi-	The Availability of Ground Water in Kent	
ment Transport on the Continental Shelf. An-	County, Delaware, With Special Reference to	Exploitation of Crayfish by Largemouth Bass
nual Progress Report,	the Dover Area,	in a Small Ohio Pond,
W73-02716 2L	W73-02806 4B	W73-02704 8I
and the state of t	CHAMBLES AND THE CONTRACT OF T	
STEVENS, J. B.	The Availability of Ground Water in New Cas-	TAYLOR, O. C.
Multi-Disciplinary Study of Water Quality		Salt Injury to Plants with Special Reference to
	tle County, Delaware,	Cations Versus Anions and Ion Activities,
Relationships: A Case Study of Yaquina Bay,	W73-02785 4B	W73-03077 3C
Oregon,		11.5-05011
W73-02921 5C	SUSSMAN, D. L.	TAVIOR O I
A CONTROL OF THE ROOM IS NOT THE PROPERTY AND ADDRESS.	Chemical and Physical Factors in the Floccula-	TAYLOR, O. J.
STEWART, R.	tion of Metal Plating Wastes with Polyelec-	A New Technique for Estimating Recharge
Handling Hot Water, With A Payoff,	trolytes,	Using a Digital Model,
W73-02780 5G		W73-02801 · 4B
31000 30	W73-02626 5D	THE PETER
STOERTZ, G. E.		TAYLOR, S. L.
	SVANIDZE, G. G.	The Antibacterial Capabilities of
Fraunhofer Line-Depth Sensing Applied to	Some Problems of the Optimal Use of a Basin	Polyhalogenated Ion Exchange Resins,
Water,	Water Resources on the Basis of Mathematical	
W73-03140 SA	Modelling,	W73-03187 5F
	W73-03227 4A	The state of the s
STOEVENER, H. H.	#13-03221 4A	TAYLORSON, R. B.
Multi-Disciplinary Study of Water Quality	SWAIN. A.	Rehydration of Phytochrome in Imbibing Seeds
Relationships: A Case Study of Yaquina Bay,		of Amaranthus retroflexus L.,
	Theoretical Study on Flap Gate Oscillation,	W73-03086 21
Oregon,	W73-03044 8B	Madical address of Note in The Substitute of
W73-02921 5C	School American Street, N. V. V. V. H. 1982.	TEN HOUTEN, J. C.
	SWEET, B. H.	Biological Effects of Air Pollution,
STOKER, J. R.	Concentration of Viruses by Osmotic Ultrafil-	
Slotted Corrugated Metal Pipe Drains,		W73-02773 5C
W73-02659 8A	tration: A Preliminary Report on the Develop-	CONTRACT OF THE
and the same of th	ment of a Model System,	TERJUNG, W. H.
STONE, G. F.	W73-03176 5A	Energy Input-Output Climates of the World: A
Aquatic Radiological Monitoring Browns Ferry		Preliminary Attempt,
	SWIENTEK, F. M.	W73-02647 2B
Nuclear Plant,	Shipboard Control of Wastes,	
W73-02736 5B	W73-02902 5G	TEST, F. L.
The second secon	30	Diffusion of Thermally Buoyant Water Jets
STRAUSS, V.	SYDYKOV, ZH. S.	into a Moving Water Stream,
The Magnitude of Shear Stresses Acting on the		
Bottom of Open Channels by Propagating	Mineral Waters Along the Eastern Edge of the	W73-02627 5B
Surge Waves,	Caspian Lowland (Mineral'nyye vody	TPOU C
W73-03038 8B	vostochnoy okrainy Prikaspiyskoy vpadiny),	TESU, C.
W 13-03030	W73-02813 4B	Investigations on the Development of Some Or-
STRAWN, R. K.	Marie Company of the	namental Wood Species on Eroded Saline Soil
	SYKES, R. M.	of the Mouth of Jijia-Bahlui Depression, (In
The Composition and Distribution of the Fish	A Computer Program for Calculating Nutrient	Rumanian),
Fauna of the Navasota River,		W73-02680 3C
W73-02613 81	Balances,	
	W73-02858 7C	TEYPLAKOV, E. P.
STUHLMAN, R. H.	The same of the sa	Fish of the Kuibyshev Reservoir (In Russian),
Shipboard Control of Wastes.	Sources of Nutrients in Canadarago Lake,	
W73-02902 5G	W73-02859 5C	W73-03083 81
117-02702	A STATE OF THE PARTY OF THE PAR	THANK P. I
SUHRBIER, J. H.	TABOREK, J.	THARPE, E. J.
	Fouling: The Major Unresolved Problem in	Water for Industrial Development in Copiah
Community Values: A Strategy for Project		and Simpson Counties, Mississippi,
Planning,	Heat Transfer,	W73-02651 3E
W73-02854 6B	W73-02775 8B	TOTAL STEER
	(Dynamillon, Control of the Control	THIPPANNAVAR, B. S.
SULZMAN, F. M.	TAKAHASI, Y.	Effect of Lateral Development of Prosopis ju-
Persisting Circadian Oscillations in Enzyme	An Alternative Approach for Finding Optimal	liflora DC. Roots on Agricultural Crops.
Activity in Non-Dividing Cultures of Euglena.	Control Rules of Reservoir Systems,	The second control of the second seco
******	W73-03231 4A	W73-03101 3F
W73-02969 5C	4A	THIRDIOT C
SUMMERS, W. K.	TAKELICHI K	THIRRIOT, C.
DOMINIDAD, W. R.	IAREUCHI, K.	Loss of Pressure Due to Periodic Movement of
Specific Capacities of Wells in Crystalline	An Alternative Approach for Finding Optimal	an Obstacle (Sur la perte de charge due a un
Rocks,	Control Rules of Reservoir Systems,	obstacle en mouvement periodique),
W73-02800 4B	W73-03231 4A	W73-03020 8B

THISSEN, J.	TUCAKOV, J.	VALENTIN, F.
The Breeding and Raising of the Pike Perch in	Contribution to the Study of the Possibilities of	Amplitude-Dependent Frequency of An Oscil-
Ponds.	Introducing Dalmatian Pyrethrum (Pyrethrum	lating Cylinder in a High-Velocity Flow,
W73-02700 81	Cinerariaefolium Trev.) In Serbia and	W73-03026 8B
W 113-021-01	Voyvodina: 3rd Report. The Influence of	
THOMANN, R. V.	Growing Site on the Percentage of Pyrethrine s,	VAN DUUREN, H.
Systems Analysis and Water Quality Manage-	W73-02672 3F	Air Pollution from Combustion Products,
	W13-02012	W73-02771 SC
ment,	Contribution to the Study of the Possibilities of	
W73-02943 5G	Introducing Pyrethrum Cinerariaefolium Trev.	VAN JAARSVELD, J. H.
THOMAS D. C.	In Servin and Voyvodina: Second Report,	A Laboratory Study on the Toxicity of Dieldrin
THOMAS, D. G.		to Fresh Water Invertebrates,
Effect of Brine Disposal Cost on Hyperfiltra-	W73-02671 3F	W73-02695 5C
tion Plant Optimization,	TUGARINA, P. Y.	117-02000
W73-02914 5E		VAN STAVERN, M. H.
	Some Blood Characteristics in Black Baikal	Method of Recovering Oil form an Oil Slick,
THOMAS, R. F.	Grayling Thymallus articus Baicalensis Dyb.	W73-03007 5G
The Miami Conservancy District Experience in	With Reference to the Estimation of the Grow-	W 13-03001
the Systems Approach to Water Quality Im-	ing Conditions (In Russian),	VAN VOAST, W. A.
provement.	W73-03111 8I	Water Resources of the Minnesota River-
W73-03225 5G	CAMPAGE AND STREET OF THE PROPERTY OF THE PROP	Hawk Creek Watershed, Southwestern Min-
	TULGAA, K.	nesota.
THOMAS, R. L.	Flood Plain Vegetation of the Middle Regions	
A System for the Rapid Analysis of Organic	of the Kerulen River (From Information of the	W73-02663 7C
	Joint Soviet-Mongolian Complex Biological Ex-	WANDENDERICON M
Phosphorus in Water Samples or Fractions	pedition of the Academy of Science of the	VANDENBEUSCH, M.
from Chromoatographic Columns,	USSR and the Academy of Science of the MP	Trajectory of Floating Bodies in a Strongly
W73-02968 5A	R. (In Russian),	Deviating Fluid Vein, (Trajectoire de corps
THE PERSON NAMED IN COLUMN TWO IS A PARTY OF THE PERSON NAMED IN C	W73-02882 2I	flottants dans une veine fluide fortement
THORBORG, C. H.	W 73-02862 21	device),
Desalting and Purifying Water by Continuous	TURNER, M. T.	W73-03035 8B
Ion Exchange,		
W73-02998 3A	Soil Associations and Land Classification for	VANDER HOOVEN, D. I. B.
WHITE HE ELECTION	Irrigation, Lincoln County,	Removing Oil or Oil Substance from Water and
TIKHONOVA, G. N.	W73-02623 3F	Land Areas Using Corncob Components,
Determination of Optimal Proportions of		W73-02991 5G
Nitrogen and Phosphorus Contents Used for	TWENTER, F. R.	
	Water for a Rapidly Growing Urban Communi-	VANDER HOOVEN, J.
Pond Fertilization, (In Russian),	tyOakland County, Michigan,	Removing Oil or Oil Substance from Water and
W73-02681 8I	W73-02804 3D	Land Areas Using Corncob Components,
The state of the s		W73-02991 5G
TIMONIN, A. G.	TYSON, P. D.	W /3-02991
Relations Between Biomass and Species Diver-	Spatial Variation of Rainfall Spectra in South	VANONI, V. A.
sity in Marine and Freshwater Zooplankton	Africa,	Temperature Effects in High-Transport, Flat-
Communities,	W73-03100 2B	
W73-02967 5C		Bed Flows,
J#1000010101	TYULENEVA, V. A.	W73-02789
TLEKIN, S. T.	Pepper Yield As Affected by	NAME OF THE OWNER OWNER OF THE OWNER OWNER OF THE OWNER OWNE
Prospects of Using Groundwaters Along the Ir-	Hydrometeorological Factors (In Russian),	VASHKEVICH, L. F.
	W73-02674 3F	The Contents of Trace Elements in Eroded Soc
tysh River Near Semipalatinsk in the National	W/3-026/4	Podzolic Soils Formed on Morainic Deposits in
Economy (Perspektivy ispol'zovaniya podzem-	UGOLINI, F.	the Poozer'e (Lake Area) of Belorussia (In
nykh vod Semipalatinskogo Priirtysh'ya v		Russian),
narodnom khozyaystve),	A Mobile Laboratory for Monitoring Environ-	W73-03214 20
W73-02812 4B	mental Pollution (In Italian),	
CONTRACTOR AND ADDRESS OF THE PARTY OF THE P	W73-03108 5A	VASILIEV, O. F.
TOEBES, G. H.	Literal tracks and the second of the second	Friction Forces of Unsteady Flows in Open
The Frequency of Oscillating Forces Acting on	UPRICHARD, S. D.	Channels and Pipes,
	The Response of Gooseberries to Non-Tillage	W73-03041 8E
Bluff Cylinders in Constricted Passages,	Systems of Management,	11 / 3 - 0 3 0 11
W73-03025 8B	W73-02699 3F	VASYANIN, K. I.
AND RESIDENCE OF THE PARTY OF T	12.00.00	Fish of the Kuibyshev Reservoir (In Russian),
TOMITA, E.	UPUSHEV, YE. M.	
Effects of Summer Application of Water and	Water Resources of the Uspenskiy Mining Dis-	W73-03083
Nitrogen on Fruit Quality and Flowering of	trict and a Technical and Economic Justifica-	MENERAL C. D.
Satsuma Orange Trees (In Japanese),	tion of Their Use (Vodnyve resursy Uspen-	VENKATARAMAN, C. P.
W73-02697 3F		Hydrodynamic Forces Caused by Unsteady
with make begins the self-the self-than the self-than	skogo rudnogo poyasa i tekhniko-	Slot Flow on Vertical Leaf Gates,
TOMITA, O.	ekonomicheskoye obosnovaniye ikh ispol'-	W73-03045 88
Dynamics of Nitric and Ammonia Nitrogen Ac-	zovaniya),	11 yeard and pour lift orders amount of
	W73-02814 4B	VENTURA, L.
cumulation in the Soil, in the Interval Between	Constitution of the section of the s	Periphyton and Phytobenthon as Indicators o
Watering in the Case of Sprinkling and Bed Ir-	USHAKOVA, V. F.	Water Quality,
rigation of Maize,	Iodine Content in the Water and Soil of Fertil-	W73-02625 5I
W73-02669 3C	ized Carp Ponds, (In Russian),	
OF THE PARTY OF	W73-02711 8I	VERKHOVSKII, B. S.
TROST, P. B.	4400	Optimum Use of Water Resources of Basins is
Environmental Dynamics of Mercury,	UZUNER, M. S.	Irrigation.
W73-02729 5B	Stability of Floating Ice Blocks,	W73-03229 31
Value of the second section of	W73-02792 2C	1,12
TRYAMKINA, S. P.		VERMA, A. P.
Effectiveness of the Use of Nutrients in Food	VALDESPINO, J. M.	On Stabilization of Fingers in a Slightly
Mixtures by Rainbow Trout, (In Russian),	Oil Entrapment and Containment Watercraft,	Cracked Heterogeneous Porous Medium,
	W73-03011 5G	W73-02830 20
W73-02896 8I	W /3-03011 3G	11 13-04030 A

	•	**		100
VE		м	А.	8.

biflora DC. Roots on Agricultural Crops, W73-03101 VERMETTE, F. L. Biochemical Scwage Treatment Via High Purity Molecular Oxygen, W73-03004 Biochemical Scwage Treatment Via High Purity Molecular Oxygen, W73-03004 Biochemical Scwage Treatment Via High Purity Molecular Oxygen, W73-03004 A Method Utilizing an Integral Formulation of Problems of Natural Vibrations of Shells in the Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in-	Resources of the Minnesota River- creek Watershed, Southwestern Min-
biflora DC. Roots on Agricultural Crops, W73-03101 VERMETTE, F. L. Biochemical Scwage Treatment Via High Purity Molecular Oxygen, W73-03004 Biochemical Scwage Treatment Via High Purity Molecular Oxygen, W73-03004 Biochemical Scwage Treatment Via High Purity Molecular Oxygen, W73-03004 A Method Utilizing an Integral Formulation of Problems of Natural Vibrations of Shells in the Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in-	creek Watershed, Southwestern Min-
W73-03101 3F W73-03052 8B nesota, W73-0262 VERMETTE, F. L. Biochemical Sewage Treatment Via High Purity Molecular Oxygen, W73-03004 5D A Method Utilizing an Integral Formulation of Problems of Natural Vibrations of Shells in the Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in W73-0292	
VERMETTE, F. L. A Method Utilizing an Integral Formulation of Biochemical Sewage Treatment Via High Purity Molecular Oxygen, W73-03004 A Method Utilizing an Integral Formulation of WHEATON On the Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in W73-029	63 7C
Biochemical Sewage Treatment Via High Puri- ty Molecular Oxygen, W73-03004 Problems of Natural Vibrations of Shells in the Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in- W73-029	
ty Molecular Oxygen, W73-03004 Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in- W73-029:	.V. a seasonous
W73-03004 5D d'une methode utilisant une formulation in- W73-0299	N, W. C. ossibility of a Market for Externalities,
a one methode difficult one formandon in-	
tegrale du probleme des vibrations propres de	Marie and ob
VERRUIT, A. coques en presence d'un fluide incompressi-	
Stationary real Transport by Plane Glound ble).	ocation for A Regional Pollution Treat-
W73-02820 2F W73-03051 8B ment Sys	
Natural Vibrations of Collindrical Challe in a	AJETDEYN SU
A New 1	Theory of Pricing and Decision-Making
cylindriques en presence de fluide). for Publi	ic Investment,
W73-03124 6B W73-03048 8B W73-029	17 6B
VIACHOS E. WATSON, J. A. Taxation	and Pollution-Some Comments,
VLACHOS, E. WATSON, J. A. Organizational Alternatives in Consolidating Ir- Annual Compilation and Analysis of Hydrolog-	35 5G
is Data for Cour Bayon Bragos Divar Basin	W TO
W73-03107 3F Texas, 1970,	re Review: Economics,
W/3-0314/	
Organizational Aspects of Irrigation Systems, W73-03106 WEDEMEYER, G. A.	remain and armine remaining
Organochlorine Insecticide Herbicide and WHITE, D.	
VLEUGELS, R. A. Polychlorinated Riphenyl (PCR) Inhibition of	llow Perch Fisheries of Deer Creek
Optimal Operation of Serially-Linked Water Nakatpase in Rainbow Trout, Reservoir	ir, Utah, with Notes on Parasitism by ntestinalis,
W/3-03163	
W73-02707 4A WEILER, F. J.	Clyestern
VUKOLOVA, A. M. Public Land Management in the Arid WHITE, N.	
Cherry Yields as Conditioned by Soil Moisture Southwest	ry Effects in Desaturation of Porous
(In Russian), W73-02679 3F W73-03122 6B Media, W73-030	064 3 2G
A STATE OF THE PROPERTY OF THE	20
WAGNER, R. H. WEISS, L. A. Maximum Concentration of Dissolved solids in Remote 1	
The Ose of Aquate Plants in the Renabilitation	Sensing of Water Pollution,
of Acid Polluted Streams, Surface Water, Harriord North Quadrangie, W73-031 W73-02611 5G Connecticut,	32 SA
W73-03155 7C WHITE, R	. K.
WAISEL, Y. Fine Str	ucture of Swarmers of Cladophora and
Discharge Hartford North Quadrangle Con-	norpha. III. Wall Synthesis and
Develop:	
W73-03154 7C	066 5C
WALLER, G. R. WHITE, W	V. B.
	Vertical Shafts in the Movement of
Effect Upon the Aquatic Diota tal Penort No. 11 2nd Half 1971	Water in Carbonate Aquifers,
W73-02609 5A W73-02712 5B	903 2F
WIEBE, H	.H.
WALLES, C. WENT, J. J. Mineral	Ion Composition of Halophytic Species
for Concentration of Viruses From Large ways 2000	orthern Utah,
Volumes of Water,	117 21
W73-03175 5A WERNER, C. WILCOX,	D. P.
WALTER H. Patterns of Drainage Areas With Random West Va	alley Reprocessing Plant. Environmen-
Mineral Ion Composition of Halophytic Species tal Report	rt No. 11, 2nd Half 1971,
from Northern Utah, W73-027	712 5E
W73-03117 2I Two Models for Horton's Law of Stream Num- WILDUNG	3. R. E.
was rica p bers, Methods	s for the Characterization of Suspended
Changes in the Peripheral Blood in Carp W/3-030/9 4A Sedimen	nt and Selected Applications for the
(Cyprinus Carpio L.) Under the Influence of WESSELS, H. R. A.	The state of the s
Ammonium Liquor (Zmiany we Krwi Ob-	5E
Wolvey Wolve Amoniakalnesi Tower Plumes, Wilkinso	ON, W. B.
W73-02158 5C W73-02763 5G Vertical	and Horizontal Laboratory Permeabili-
ty Measu	urements in Clay Soils,
Walter Marianian Barrett Tules	333 20
Groundwater Flow in Partially Saturated Soils, W73-02624 Environmental Monitoring Report: July- December 1971 and 1971 Summary, WILL, R.	G. and in comment interests
W73-02709 5B Method	and Apparatus for Removing Oil and
WARLUZEL, A. Debris fi	rom Water,
Damping of Natural Vibrations of an Immersed Cylindrical Shell with Free Ends: Influence of A C-14 Assay for Photorespiration in Aquatic	97
	er Separating Process.
Commences of the right by an Axial Spell Flagits. On-wall	999 50

WILLI Solding Will Map Will Ma

		27110253, 3.
WILLIAMS, J. R. Sediment Yield Computed With Universal Equation,	YAKOVLEVA, A. N. Natural Reroduction of Fish in the Volgograd Reservoir (In Russian),	ZIEGLER, H. Eco-Physiological Studies on Desert Plants. III. Respiration of Negatively Photoblastic
W73-02794 2J	W73-03102 8I	Zygophyllum coccineum L. Seeds During Ger- mination.
WILLIAMS, P. I Map Showing Drainage Basins and Historic	YAMAMOTO, T. Virus-Sized Particle Adsorption on Soil-Part I:	W73-03116 21
Cloudburst Floods in the Salina Quadrangle,	Rate of Adsorption,	ZITO, G. A Method for the Determination of the Ther-
Utah, W73-03152 7C	W73-03177 5B	mal Properties of Soil Near the Surface, W73-03076 2G
WILLIS, D. L.	YAMAMOTO, Y. Determination of A Trace Amount of Cadmium	ZOLOTOV, L. A.
Radionuclide Cycling in Natural Populations of Amphibians. Annual Progress Report, June 16, 1971 - June 15, 1972,	in Water by Atomic Absorption Spec- trophotometry Combined with Ammonium Pyr- rolidine Dithiocarbamate-Methl Isobutyl	Moment Characteristics of Cascades Under Nonstationary Flow Conditions, W73-03029 8B
W73-02755 5C	Ketone Extraction Using Large Aqueous Phase/Solvent Rati os,	ZVIRGZDS, J.
WILSON, A. W. The Future Human Occupance of the Arid	W73-02939 5A	The Influence of Herbicide 2,4-D-NA on Respiration and Survival of Simocephalus vetu-
Southwest, W73-03121 6B	YAMANAKA, S. Pollution by Coliform Bacteria in Sea Water of	lus (O.F. Muller) (Cladocera), W73-03166 5C
WILSON, J. L.	Swimming Resorts: II (In Japanese), W73-02928 5B	
Gravitational and Dispersive Mixing in Aquifers,	YAMANE, Y.	
W73-02791 2F	Determination of Total Mercury in Sludge (In	
WILSON, R. H.	Japanese), W73-02945 5A	
Towards a Philosophy of Planning: An Investigation into Attitudes Held by Federal	YAROSHEVICH, L. M.	
Water Resource Planners, W73-02955 6E	The Contents of Trace Elements in Eroded Sod Podzolic Soils Formed on Morainic Deposits in	
WISSE, J. A.	the Poozer'e (Lake Area) of Belorussia (In	
A Method for Calculating the Size of Cooling Tower Plumes.	Russian), W73-03214 2G	
W73-02763 5G	YEVJEVICH, V.	
WITHERSPOON, D. F. Great Lakes Simulation ModelA Decision	An Application of Multi-variate Analysis in Hydrology,	
Aid,	W73-02873 2E	
	YOUNGER, J. S. An Investigation into the Flow Behaviour	
WOLFE, R. S. Microbial Modification of Ground Water, W73-02602 5B	Through Compacted Saturated Fine-Grained Soils with Regard to Fines Content and Over a Range of Applied Hydraulic Gradients,	
WOOD, R. D.	W73-02835 2G	
Periphyton and Phytobenthon as Indicators of Water Quality,	ZAKORA, L. P. Feeding Rhythm of Sturgeon in the Volgograd	
W73-02625 5B	Reservoir, (In Russian),	
WOODWARD, R. L. Salt Creek Two Stage Nitrification Plant,	W73-02685 8I	
W73-02963 5D	ZAUGG, R. E. Multichamber Floating Barrier,	
WOOLHISER, D. A.	W73-03015 5G	
Experimental Investigation of Converging Overland Flow,	ZEIKUS, J. G. Microbial Modification of Ground Water,	
W73-03018 2E	W73-02602 5B	
WRENN, M. E. Environmental Sampling for River Sediments	ZEMLYANOI, A. D.	
Around a Nuclear Power Station, W73-02740 5B	Radioactivity of Waters in Northeastern Part of Atlantic Ocean,	
WRIGHT, T. L.	W73-02710 5B	
Gromet II-Rainfall Augmentation in the Philip-	ZEYBERLIKH, N. E. Mineral Waters Along the Eastern Edge of the	
pine Islands, W73-03149 3B	Caspian Lowland (Mineral'nyye vody vostochnoy okrainy Prikaspiyskoy vpadiny),	
Project Foggy Cloud III, Phase 1,	W73-02813 4B	
W73-03145 3B	ZHULYOVA, I. S.	
YAGER, T. U. Available Water Capacities of Zambian Soils in Relation to Pressure Plate Measurements and	Hydrodynamic Forces Due to Nonstationary Oscillations of Cylindrical Shells in a Fluid Medium with Deformations of the Cross-Sec-	
Particle Size Analysis, W73-03065 2G	tion Taken into Account, W73-03047 8B	

to reducing the Council of part of a behaviorable of the range of the state and the state of t Applies, A. J. Stranger, A. M. and the color of great of all health a. THE STATE OF THE S

AGRI URBA CONS Pati tion Pre W7 AGRI WESI CONS Eff

ACAD INSTIT On hom W73 ACAD PAVL STATI Irrig Post

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W73 AGRIC EDUC. FLA. Ana AGRIC BELTS

RESE Reh of A W73 AGRIC COLL Exp Ove W73

AGRI RIESE DIV. Sed Equ W73 AGRI RIVE CONS

Inte Sug AGRI TUCS Mo Var

(Go Cel W7 AGRI (NET FERT The Vis

ORGANIZATIONAL INDEX

ACADEMIA R. S. R., BUCHAREST.	AIR-GEST INTERNATIONAL CORP.,	Underground Mineral Water of Alpine Regions
INSTITUTUL DE MATEMATICA.	MONTREAL (QUEBEC). (ASSIGNEE)	of Southeastern Kazakhstan (Podzemnyye
On the Plane Steady Flow Through In- homogeneous Porous Media,	Sewage Treatment Apparatus, W73-02987 5D	mineral'nyye vody vysokogornykh rayonov Yugo-Vostochnogo Kazakhstana).
W73-02824 2F	W 13-02981	W73-02818 4B
PROGRAMMA CONTRACTOR OF THE CO	AKADEMIYA NAUK GRUZINSKOI SSR,	T CASCATOR TO THE PROPERTY OF THE PARTY OF T
ACADEMY OF AGRICULTURAL SCIENCES,	TIFLIS. INSTITUT ENERGETIKI.	AKADEMIYA NAUK KIRGIZSKOI SSR,
PAVLIKENI (BULGARIA). EXPERIMENT STATION OF IRRIGATED AGRICULTURE.	Some Problems of the Optimal Use of a Basin	FRUNZE. TYANSHANSKAYA VYSOKOGORNAYA
Irrigation of Maize and Sunflower Grown as	Water Resources on the Basis of Mathematical Modelling.	FIZIKO-GEOGRAFICHESKAYA STANTSIYA.
Post-Harvest Silage Crops in the Region of	W73-03227 4A	Some Features of Tien Shan Glaciers (Nekoto-
Rossitza Irrigation System,		ryye zakonomernosti oledeneniya Tyan'-
W73-02670 3F	AKADEMIYA NAUK KAZAKHSKOI SSR,	Shanya).
AGRICULTURAL RESEARCH AND	ALMA-ATA. INSTITUT ENERGETIKI. Optimization of Basin Water Resources Utiliza-	W73-02633 2C
EDUCATIONAL CENTER, LAKE ALFRED,	tion,	Mass Budget of the Kara-Batkak Glacier on the
FLA.	W73-03228 4A	Northern Slope of the Terskey Ala-Too Range
The Use of a Multi-Celled Apparatus for		(Byudzhet lednikov severnogo sklona khrebta
Anaerobic Studies of Flooded Root Systems,	AKADEMIYA NAUK KAZAKHSKOI SSR,	Terskey Ala-Too na primere lednika Kara-Bat-
W73-03194 2I	ALMA-ATA. INSTITUT GIDROGEOLOGII I GIDROFIZIKL	kak), W73-02634 2C
AGRICULTURAL RESEARCH SERVICE.	Regional Hydrogeologic Investigations in	
BELTSVILLE, MD. PLANT SCIENCE	Kazakhstan (Regional'nyye	Water Balance of the Kara-Batkak Glacier
RESEARCH DIV.	gidrogeologicheskiye issledovaniya v Kazakh-	Basin (Vodnyy balans lednikovogo basseyna na
Rehydration of Phytochrome in Imbibing Seeds	sta	primere lednika Kara-Batkak), W73-02635 2C
of Amaranthus retroflexus L.,	W73-02809 4B	AV. SYDEFTW
W73-03086	Groundwaters of Kazakhstan and Recommen-	Ablation of the Semenov Glacier (Tayaniye led-
AGRICULTURAL RESEARCH SERVICE, FORT	dations Regarding Their Use in the National	nika Semenova), W73-02636 2C
COLLINS, COLO.	Economy for 1976-80 (Podzemnyye vody	W73-02636 2C
Experimental Investigation of Converging	Kazakhstana i rekomendatsii po ikh ispol'-	Rate of Movement, Ablation, and Dynamics of
Overland Flow, W73-03018 2E	zovaniyu v narodnom khozyaystve v period s	Some Glaciers of the Ak-Shiyrak Range
W73-03018 2E	1976 po 1980 g.),	(Skorostnoy rezhim, tayaniye i dinamika neko-
AGRICULTURAL RESEARCH SERVICE,	W73-02810 4B	torykh lednikov massiva Ak-Shiyrak), W73-02637
RIESEL, TEX. SOIL AND WATER RESEARCH	Role of Groundwater in Maintaining the Level	# 15-02057
DIV.	of Lake Balkhash (Rol' podzemnykh vod v	Heat Balance of the Kara-Batkak Glacier Sur-
Sediment Yield Computed With Universal	podderzhanii urovnya oz. Balkhash),	face During an Ablation Season (Teplovo)
Equation, W73-02794 2J	W73-02811 4B	balans poverkhnosti lednika Kara-Batkak v period tayaniya),
William State Stat	Prospects of Using Groundwaters Along the Ir-	W73-02638 2C
AGRICULTURAL RESEARCH SERVICE,	tysh River Near Semipalatinsk in the National	
RIVERSIDE. SOIL AND WATER	Economy (Perspektivy ispol'zovaniya podzem-	Dynamics and Structure of the Yuzhnyy In-
CONSERVATION RESEARCH DIV. Interaction of Temperature and Salinity on	nykh vod Semipalatinskogo Priirtysh'ya v	yl'chek Glacier (Voprosy dinamiki i struktury lednika Yuzhnyy Inyl'chek),
Sugar Beet Germination,	narodnom khozyaystve), W73-02812 4B	W73-02639 20
W73-03084 3C	W 13-02012	
NE SERVICE DE LA CONTRACTOR DE LA CONTRA	Mineral Waters Along the Eastern Edge of the	Morphology of Glacial Lake Merzbacher and Mechanics of its Catastrophic Outburst (Mor-
AGRICULTURAL RESEARCH SERVICE,	Caspian Lowland (Mineral'nyye vody vostochnoy okrainy Prikaspiyskoy vpadiny),	fologiya lednikovogo ozera Mertsbakhera
TUCSON. PLANT RESEARCH DIV. Morphological Response of Two Mesquite	W73-02813 4B	mekhanizm yego katastroficheskikh proryvov),
Varieties to 2,4,5-T and Picloram,	11302013	W73-02640 20
W73-03080 4A	Water Resources of the Uspenskiy Mining Dis-	Secular Growth of Some Tien Shan Glaciers (C
A COLOUR STOLL PROPERTY BOTH CORPUTOR	trict and a Technical and Economic Justifica-	poluvekovom razvitii nekotorykh Tyan'-Shan'
AGRICULTURAL RESEARCH SERVICE, URBANA, ILL. SOIL AND WATER	tion of Their Use (Vodnyye resursy Uspen- skogo rudnogo poyasa i tekhniko-	skikh ledníkov),
CONSERVATION RESEARCH DIV.	skogo rudnogo poyasa i tekhniko- ekonomicheskoye obosnovaniye ikh ispol'-	W73-02641 20
Patterns of Water Uptake and Root Distribu-	zovaniya),	Mechanism of the Formation of Some 'Ter
tion of Soybeans (Glycine max.) in the	W73-02814 4B	minal Moraines' and Role of Water in Glacia
Presence of a Water Table,	Manitories Commitmeter Becompies in Bird	Erosion (Mekhanizm obrazovaniya nekotoryk)
W73-03114 3F	Monitoring Groundwater Reservoirs in Pied- mont Plains of Tien Shan (Upravleniye	'konechnykh moren' i rol' vodnoy erozii v
AGRICULTURAL RESEARCH SERVICE,	rezhimom podzemnykh vod na predgornykh	dinamike lednika), W73-02642 20
WESLACO, TEX. SOIL AND WATER	ravninakh Tyan' -Shanya),	W 13-Valla
CONSERVATION RESEARCH DIV.	W73-02815 4B	AKADEMIYA NAUK LITOVSKOI SSR,
Effects of Salt Treatments of Cotton Plants (Gossypium hirsutum L.) on Leaf Mesophyll	Occurrence of Groundwater in the Piedmont	VILNIUS. INSTITUT ZOOLOGII I PARAZITOLOGII.
Cell Microstructure,	Alluvial Plain on the Northern Slope of Dzun-	Growth Characteristics, Structure and
W73-03081 3C	garian Ala Tau (Formirovaniye podzemnykh	Abundance of Abramis Brama (L.) In the
	vod predgornogo shleyfa severnogo sklona Dz-	Water Passages of the Summer Diked Marshe
AGRICULTURAL UNIV., WAGENINGEN	hungarskogo Alatau),	of the Nyamunus Delta (In Russian),
(NETHERLANDS). LAB. OF SOILS AND FERTILIZERS.	W73-02816 4B	W73-02678
The Significance of the Net Transfer of	Groundwater of the Akdala River Valley and	AKADEMIYA NAUK SSSR, MOSCOW.
Viscous Stress Energy and the Local Produc-	Prospects of its Use as a Water-Supply Source	GEOLOGICHESKII INSTITUT.
tion of Kinetic Energy in Stationary Soil Water	(Podzemnyye vody doliny r. Akdala i perspek-	Origin of Manganese Nodules of the Pacific
Flow,	tivy ikh ispol'zovaniya dlya vodosnabzheniya),	Ocean From Radioisotope Data, W73-02752 5E
W73-02821 2G	W73-02817 4B	W73-02752 5E

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT OKEANOLOGIL Uranium Concentration in Recent Ocean Sediments in Zones of Rising Currents, W73-02748 5B	ARID LAND RESEARCH CENTER, ABU DHABI (TRUCIAL OMAN). Vegetable Production Under Plastic on the Desert Seacoast of Abu Dhabi, W73-03110 3F	ARMY ENGINEER DISTRICT, ROCK ISLAND, ILL. Flood Control at Muscatine, Iowa (Final En- vironmental Impact Statement). W73-03017 4A
AKADEMIYA NAUK URSR, KIEV. MORSKYI		ARMY ENINEER DIV. SOUTH PACIFIC, SAN
RAGioactivity of Waters in Northeastern Part of Atlantic Ocean, W73-02710 5B	ARIZONA STATE UNIV., TEMPE. DEPT. OF CIVIL ENGINEERING. Discussion of Waste Disposal in Arid Lands, W73-03129 5F	FRANCISCO, CALIF. COASTAL ENGINEERING BRANCH. A Glossary of Coastal Engineering Terms. W73-02654 8B
AKADEMIYA NAUK URSR, LVOV. INST. OF	ARIZONA STATE UNIV., TEMPE. DEPT. OF POLITICAL SCIENCE.	ARMY MOBILITY EQUIPMENT RESEARCH
Modes of Bog Development in the Ukrainian Carpathians (In Russian),	Planning our Urban Environment in the Southwest, W73-03124 6B	AND DEVELOPMENT CENTER, FORT BELVOIR, VA. SANITARY SCIENCES DIV. Evaluation of Potable Water Storage Tanks,
SHE OF AMERICA SPANNESS AND SO SERVED SHOW	ARIZONA UNIV., TUCSON.	W73-02656 5G
AKTIEBOLAGET GUSTAVSBERGS FABRIKER (SWEDEN). (ASSIGNEE). Apparatus for Biologically Purifying Sewage,	Data Collection for Water Systems Control, W73-03241 7C	ATOMIC ENERGY COMMISSION, WASHINGTON, D.C.
W73-03014 5D	ARIZONA UNIV., TUCSON. DEPT. OF	Radioactive Waste Repository, Lyons, Kansas, (Final Environmental Impact Statement).
ALASKA UNIV., COLLEGE. INST. OF MARINE	GEOGRAPHY AND AREA DEVELOPMENT.	W73-02721 5C
SCIENCE.	The Future Human Occupance of the Arid Southwest.	ATOMIC ENERGY OF CANADA LTD., CHALK
Feasibility Study of the Application of Solvent Extraction and Gas-Liquid Partition Chro-	W73-03121 6B	RIVER (ONTARIO). CHALK RIVER NUCLEAR LABS.
matography to Marine Trace Metal Analysis, W73-02747 5A	ARIZONA UNIV., TUCSON. DEPT. OF SYSTEMS ENGINEERING.	Progress Report, Biology and Health Physics Division, Environmental Research Branch,
ALASKA UNIV., FAIRBANKS. INST. OF	Measurements of Turbulence in Water at High	January 1972 to March 31, 1972, W73-02725 5C
MARINE SCIENCE. Trace-Metal Associations in Sub-Artic and Arc-	Velocity, W73-02790 2E	
tic Marine Environments - Progress Report,		AZOVO-CHERNOMORSKII SELSKOKHOZYAISTVENNYI INSTITUT.
June 1971-May 1972, W73.02754 SR	ARIZONA UNIV., TUCSON. ENVIRONMENTAL RESEARCH LAB.	ROSTOV-NA-DONU (USSR).
Lorgial Saleskov manelyn Alt Shigmest.	Scrubbed Diesel Exhaust for Carbon Dioxide	The Role of Zoobenthos in the Feeding of Bot- tom-Feeding Fish and the Food Supply After
ALL-UNION DESIGNING, SURVEYING AND SCIENTIFIC RESEARCH INST.	Enrichment of Greenhouse Vegetables, W73-03074 3F	the Damming of the Don (In Russian),
HYDROPROJECT, MOSCOW (USSR).		W73-02677 2L
Hydrodynamic Pressure of Nonstationary Flow	Use of Digital Computers for the Heat and Mass Transfer Analyses of Controlled Environ-	BABCOCK AND WILCOX CO., LYNCHBURG,
in Canals Acting on Moored Ships, W73-03033	ment Greenhouses, W73-03082 2D	VA. POWER GENERATION DIV. Waste Management,
The Impact of the Jet on the Obstacle,		W73-02734 5B
W73-03037 8B	A Plastic Inflated Environmental Growth Chamber.	BARI UNIV. (ITALY). ISTITUTO DI GEODESIA
ALLIED RESEARCH ASSOCIATES, INC., LANHAM, MD.	W73-03095 3F	A Method for the Determination of the Ther-
Hydrologic Conditions Viewed by the Nimbus	A Hydrophilic Polymer as a Soil Amendment, W73-03098	mal Properties of Soil Near the Surface, W73-03076 2G
Meteorological Satellites, W73-03135 7B	CALL OF SERVICE AND ASSESSMENT OF THE PROPERTY.	
AMERICAN WATER WORKS ASSOCIATION,	An Integrated System for Providing Power, Water and Food for Desert Coasts,	BATTELLE MEMORIAL INST. COLUMBUS, OHIO.
NEW YORK. COMMITTEE ON FINANCIAL	W73-03099 E 3F	Environmental Benefit-Cost Analysis for Nuclear Power Generation,
ASPECTS OF FIRE PREVENTION AND PROTECTION.	Response of Osmotically Stressed Plants to	W73-02840 6B
A Businesslike Approach to Fire Prtoection	Growth Regulations, W73-03104 3C	BATTELLE MEMORIAL INST., COLUMBUS,
Charges. W73-02864 3D		OHIO. COLUMBUS LABS.
AMERICAN WATER WORKS ASSOCIATION	Morphological and Anatomical Aspects of Oedema in Eggplants (Solanum melongena L.),	Tritium and Its Effects in the Environment - A Selected Literature Survey.
RESEARCH FOUNDATION, NEW YORK. Water-Treatment-Plant Waste DisposalAction	W73-03105 2I	W73-02720 5C
Now,	ARKANSAS UNIV., FAYETTEVILLE, DEPT. OF AGRICULTURAL ECONOMICS AND RURAL	BATTELLE-PACIFIC NORTHWEST LABS.,
W73-02964 5F	SOCIOLOGY.	RICHLAND, WASH. Evaluation of Environmental Factors Affecting
ANDERSON COB MILLS, INC., MAUMEE,	Catfish Production in Southeastern Arkansas:	Population Exposure
OHIO. (ASSIGNEE) Removing Oil or Oil Substance from Water and	Estimated Investment Requirements, Costs, and Returns, for Two Sizes of Farms,	W73-02733 5B
Land Areas Using Corncob Components,	W73-02926 3E	Methods for the Characterization of Suspended
W73-02991 5G	ARMY ENGINEER DISTRICT, BALTIMORE,	Sediment and Selected Applications for the Acquired Data,
ARGONNE NATIONAL LAB., ILL.	MD.	W73-02977 5B
Fuel Cycles and the Fast Breeder Reactor,	The Codorus Creek Wastewater Management Study, Summary Report and Conclusions.	BAYLOR COLL, OF MEDICINE, HOUSTON,
W73-02765 5G	W73-02869 5G	TEX. DEPT. OF VIROLOGY AND
ARGONNE NATIONAL LAB., ILL. CENTER FOR ENVIRONMENTAL STUDIES.	ARMY ENGINEER DISTRICT, CHICAGO, ILL.	Progress in the Development of an Apparatus
The Relationship Between Land Use and En-	Milwaukee Diked Disposal Area, Wisconsin,	for Concentration of Viruses From Large
vironmental Protection, W73-02915 4A	(Draft Environmental Impact Statement). W73-03151 5G	Volumes of Water, W73-03175 5A
**************************************	11.5-05.51	11 10 00 10 OA

BELIC CONTINUE OF THE PROPERTY OF THE PROPERTY

ORGANIZATIONAL INDEX

COLLEGE OF AGRICULTURE, INDORE (INDIA).

Contribution to the Study of the Possibilities of Introducing Pyrethum Cinerariacidonium Trev. WT-2021 Second Report. WT-2022 Second Report. WT-202			
WT-20271 WT-20271 Empact of Soewpack Management on Soew-Mocking Dahmatian Pyrethrum (Pyrethrum Carrelated) in Introducing Dahmatian Pyrethrum (Pyrethrum Warrelated) in Introducing Dahmatian Pyrethrum (Pyrethrum Warrelated) in International Control of Report. The Influence of Voycolina: 3rd Report. The Influence of Voycolin	Contribution to the Study of the Possibilities of Introducing Pyrethrum Cinerariaefolium Trev.	Behavior Results for Morrow Point Dam,	
Contribution to the Study of the Possibilities of Entroducing Deliminating Preforms (Preform Cineralizefolium Trev.) in Stribs and Convening Size on the Percentage of Pyrethrine s, W73-02672 In Emportance of a Practical Research layer to the Market Stribs of Convening Size on the Percentage of Pyrethrine s, W73-02672 Spongova UNIV. (TRAIT), CLAMICIAN CHEMICAL INST. Methyl Mercury Acetate From Waters by Chromatography on Chelaing Polymers, Water Schools on Chemical Professor of Stribs and Barbara County, Water Schools, Professor of Stribs Barbara County, W73-0208 BRIGHAM YOUNG UNIV., PROVO, UTAL The Yoldow Professor of Stribs Barbara County, W73-0208 BRIGHM YOUNG UNIV., PROVO, UTAL The Yoldow Professor of Stribs Barbara County, W73-0208 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. AND ESSEARCH DEPT. OF COUNTY-02024 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. AND ESSEARCH DEPT. OF COUNTY-02024 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. AND ESSEARCH DEPT. OF COUNTY-02024 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. Collined Flows, W73-02034 W73-02034 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. Collined Flows, W73-02034 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. Collined Flows, W73-02034 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. Collined Flows, W73-02034 BRISTOL UNIV. (RNGIAND), DEPT. OF CIVIL ENGINEERING. Collined Flows, W73-02034 BRISTOL UNIV. (RNGIAND), DEPT. OF COUNTY (RNGIAND), W73-02034 BRISTOL UNIV. (RNGIAND), DEPT. OF COUNTY (RNGIAND), W73-02034 BRISTOL UNIV. (RNGIAND), WAS AN			
Introducing Delmatian Prevarbum (Pyrethrum (Contribution to the Study of the Possibilities of		SOIL SCIENCE. Salt Injury to Plants with Special Reference to
VOY-OGEN AND ANALOGE STREET OF STREE	Introducing Dalmatian Pyrethrum (Pyrethrum	The Importance of a Practical Research Input	Cations Versus Anions and Ion Activities,
W73-0937 BOLOGNA UNIV. (TTALY). CIAMICIAN MIDLIER, OCOLBIA, MO, PSIS.PESTICIDE RESEARCH LAB. Water Requirements of Santa Barbara County, 1967 to 1990. W73-0388 BOKORANA AND EDMONSTON, GLENDALE, ALIF. Water Requirements of Santa Barbara County, 1967 to 1990. W73-0388 REIGHAM YOUNG UNIV., PROVO, UTAB. The Yellow Perch Fisheries of Deer Creek RESPORCES. The Temperature Effects in High-Transport, Flat- Emperature Development of Association of Square All-FORMAL UNIV, BERKELEY, DEPT. OF EMILIER COLUMBIA UNIV, VANCOUVER. BUILTEUR COLUMBIA UNIV, VANCOUVER, BUILTEUR COLUMBIA UNIV, VANCOUVE	Voyvodina: 3rd Report. The Influence of	to Water Resources Development,	ALCOHOL: PARTY AND ALCOHOL: NO CONTROL OF THE PA
WILDLIFE, COLUMBIA, MO, FISSPESTICIDE (EMEMICAL INST. Methyl Mexcury Acetate From Waters by Chonastography on Chebating Polymers, W73-03179 Methodism of Diazinon by Fish Liver Microsomes, W73-03179 MERCHAM YOUNG UNIV., PROVO, UTAL. MERCHAM YOUNG UNIV., PR			SPRINGS, OHIO.
Microsomes, W73-03179 BOOKMAN AND EDMONSTON, GLENDALE, CALFORNIA INST. OF TECH, PASADENA, W. MCECK LEAR OF PHYDRAULICS AND WATES 1967 to 1990, W73-02868 BERIGHAN VOUNG UNIV, PROVO, UTAL. The Yellow Prich Fisheries of Deer Creek Reservoir, Univ. with Notes on Parsitism by Liquila Intestinalis, w73-02701 BRISTOL UNIV. (RNICLIND). DEPT. OF CIVIL NORTH PRICE	CHEMICAL INST.	WILDLIFE, COLUMBIA, MO. FISH-PESTICIDE RESEARCH LAB.	Ground Water in Carbonate Aquifers,
ROOKMAN AND EDMONSTON, GLENDALE, Water Requirements of Santa Barbara County, 1967 to 1999, W73-22858 BRICHAM YOUNG UNIV, PROVO, UTAB. The Yellow Perch Fisheries of Deer Creek Reservoir, Utab, with Notes on Parasitism by Ligula Intestinalis, W73-02759 BRISTOL UNIV, (ENGLAND) DEPT. OF CIVIL RESURCES, Flow-Induced Dynamic Pressures on Square- Section Cylinders, W73-02020 BRISTOL UNIV, (ENGLAND) DEPT. OF CIVIL RESURCES, Flow-Induced Dynamic Pressures on Square- Section Cylinders, W73-03020 BRISTOL UNIV, (ENGLAND) DEPT. OF CIVIL W73-03266 BRISTOL UNIV, WATER AND DEPT. OF CIVIL UNIV, BREKELEY, DEPT. OF BURGHAIR UNIV, BERKELEY, SCHOOL OF FIRILA HEALTH. Laboratory Studies on the Survival of Poliorium in Algal-Bacterial Wastewater Treat- ment Systems, W73-03255 BUCHAREST UNIV, (RUMANIA). Considerations Reparding Distribution of Complex, (In Rumanian Complex, (In Rumanian Complex, Cin Rumanian Complex Cin	Chromatography on Chelating Polymers,	Microsomes,	ARLINGTON, VA. SYSTEMS EVALUATION
Wark Requirements of Santa Barbara County, 1967 to 1990, W73-02568 BRIGHAM YOUNG UNIV., PROVO, UTAH. The Yellow Perch Fisheries of Deer Creek Reservoir, Utah, with Notes on Parasitism by Legals Intestinatis. W73-02701 BRISTOL UNIV. (ENGLAND), DEPT. OF CIVIL. BRISTOL UNIV. (ENGLAND), DEPT. OF CVILL BRISTOL UNIV. (ENGLAND), DEPT. OF COLUMNIA UNIV., VANCOUVER. Oxygen Transfer to Water and to Sodium Sulfite Solution in the Crapina-Jijia Maraby Comjet. (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Bristolia (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Bristolia (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Bristolia (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Bristolia (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Bristolia (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Bristolia (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Distribution of Phytoplankton in the Crapina-Jijia Maraby Comjet. (England) Distribution of Distribution of Distribution of Distribution of Distribution of Distribution of Distribut			Cost Analysis of Optional Methods of Ship-
1967 to 1990, W73-02968 BRIGHAM YOUNG UNIV, PROVO, UTAL. The Yellow Perch Fisheries of Deer Creek Light Intentional, th Notes on Parasithins by W73-02791 SI W73-02792		RESOURCES.	
BRIGHAM YOUNG UNIV, PROVO, UTAH. The Yellow Perch Fisheries of Deer Creek Reservoir, Usah, with Notes on Parasitism by Ligula Intestinalis, W73-02790 BRISTOL UNIV. (RNGLAND, DEPT. OF CIVIL ENGINEERING.) Flow-Induced Dynamic Pressures on Square-Section Cylinders, W73-03022 BRISTOL UNIV. (RNGLAND, DEPT. OF CIVIL ENGINEERING.) Flow-Induced Dynamic Pressures on Square-Section Cylinders, W73-03024 BRISTOL UNIV. (RNGLAND, DEPT. OF CIVIL ENGINEERING.) Flow-Induced Dynamic Pressures on Square-Section Cylinders, W73-03024 BRISTOL UNIV. (RNGLAND, DEPT. OF CIVIL ENGINEERING.) Flow-Induced Dynamic Pressures on Square-Section Cylinders, W73-03024 BRISTOL UNIV. (RNGLAND, DEPT. OF CIVIL ENGINEERING.) Flow-Induced Dynamic of Two-Dimensional Structures in Confined Flows, W73-03024 BRISTOL UNIV., VANCOUVER. Oxygen Transfer to Water and to Sodium Sulfite Solutiona, W73-02862 BRITISH COLUMBIA UNIV., VANCOUVER. Oxygen Transfer to Water and to Sodium Sulfite Solutiona, W73-02862 BRICHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytophankton in the Crapina-Jijila Marshy Complex, (In Rumanian). W73-02862 BUERAU OF LAND MANAGEMENT, W73-02866 CALIFORNIA UNIV., DAVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY. PUBLIC HEALTH. Public Land Management in the Arid Southwests. W73-03122 GBUERAU OF LAND MANAGEMENT, W73-03793 GBUERAU OF RADIOLOGICAL HEALTH, CHENCE S. W73-03122 GBUERAU OF RADIOLOGICAL HEALTH, CHENCE S. W73-03123 GBUERAU OF RADIOLOGICAL HEALTH, CHENCE S. W73-03132 GBUERAU OF RADIOLOGICAL HEALTH, CHENCE S. W73-0375 GCALIFORNIA UNIV., DAVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY. W73-03075 AND PLANT NUTUTION. Calcium and Salt Toleration by Bean Plants, W73-03935 AND PLANT NUTUTION. CALIFORNIA UNIV., LOVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY. W73-0375 AND PLANT NUTUTION. CALIFORNIA UNIV., LOVIS. DEPT. OF GOOD SCIENCE AND TECHNOLOGY. W73-03075 AND PLANT NUTUTION. CALIFORNIA UNIV., LOVIS. DEPT. OF GOOD SCIENCE AND TECHNOLOGY. W73-03075 AND PLANT NUTUTION. CALIFORNIA UNIV., LOVIS. AND FLANT SCIENCE S	1967 to 1990,		
The Yellow Perch Fisheries of Deer Creek Reservoir, Utah, with Notes on Parasitism by Ligula Intestinalis, was also provided the programs, was also provided by Ligula Intestinalis, was also provided Regional Was also	THE STREET AND A COLUMN TO	W73-02789 2J	STATION, POONA (INDIA).
WT3-02599 RRISTOL UNIV. (ENGLAND), DEPT. OF CIVIL ENGINEERING, Flow-induced Dynamic Pressures on Square-Section Cylinders, WT3-03022 Wake Dynamics of Two-Dimensional Structures in Confined Flows, WT3-03024 Wake Dynamics of Two-Dimensional Structures in Confined Flows, WT3-03024 BRITTSH COLUMBIA UNIV., VANCOUVER, Oxygen Transfer to Water and to Sodium Sulfite Solutions, WT3-03024 BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian). WT3-02666 BUREAU OF LAND MANAGEMENT, FHOENIX, ARIZ. Public Land Management in the Arid Southwest, WT3-03123 BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Addition and Salt Toleration by Bean Plants, WT3-03123 BUREAU OF RADIOLOGICAL REALTH, CINCINNATI, OHIO, RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, WT3-03173 BUREAU OF RECLAMATION, DENVER, COLO. Scripper of Chilago Principles of California del Hydrocarbon Residues in Waters and Selements From Storage Reservoirs, Scripper of Regional Water Quality Management of Analytical Procedures for Determining Chole of Two-Dimonstrate Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian). 21 CALIFORNIA UNIV., DAVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY. Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, WT3-02779 SCIENCE AND TECHNOLOGY. Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, WT3-02794 CALIFORNIA UNIV., DAVIS. DEPT. OF SOILS AND FALLY, INVIDED DEPT. OF GEOGRAPHY. Two Models for Forton's Law of Stream Numbers, WT3-03079 AND PLANT NUTRITION. CREATED AND WASHINGTON, DENVER, COLO. TRINGFINE AURITHMENT AND MANAGEMENT, WASHINGTON, DENVER, COLO. TRINGFINE AURITHMENT AND MANAGEMENT, CREATED AND MANAGEMENT, WASHINGTON, DENVER, COLO. TRINGFINE AURITHMENT AND MANAGEMENT, WASHINGTON, DENVER, COLO. TRINGFINE AURITHMENT AND MANAGEMENT, WASHINGTON, DEPT. OF GEOGRAPHY. Two Models f	The Yellow Perch Fisheries of Deer Creek	MATERIALS AND RESEARCH DEPT.	Slot Flow on Vertical Leaf Gates,
BRISTOL UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING. Flow-Induced Dynamic Pressures on Square-Section Cylinders, W73-03022 Wake Dynamics of Two-Dimensional Structures in Confined Flows, W73-03024 BB WAR-Dynamics of Two-Dimensional Structures in Confined Flows, W73-03248 BRITISH COLUMBIA UNIV., VANCOUVER. CONJECT Segrating Distribution of Phytoplankton in the Crajins-Jijila Marshy Complex, (In Rumanian), W73-03262 BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crajins-Jijila Marshy Complex, (In Rumanian), W73-03266 BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crajins-Jijila Marshy Complex, (In Rumanian), W73-03079 BUREAU OF LAND MANAGEMENT, FHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03123 BUREAU OF LAND MANAGEMENT, W73-03123 BUREAU OF LAND MANAGEMENT, W73-03123 BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO, RADIOLOGICAL ELEATH, CINCINNATI, OHIO, RADIOLOGICAL ELEA			CENTRE D'OCEANOGRAPHIE, MARSEILLE
Flow-Induced Dynamic Pressures on Square- Section Cylinders, W73-03022 Wake Dynamics of Two-Dimensional Struc- tures in Confined Flows, W73-03024 BBRTISH COLUMBIA UNIV., VANCOUVER. Coygea Transfer to Water and to Sodium Sulfite Solutions, W73-03172 BUCRAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Chyliophankton in the Crapina-Jijila Marshy Complex, (in Rumanian), W73-03122 BUREAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 BUREAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 CALIFORNIA UNIV., DAVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY. AND PLAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 CALIFORNIA UNIV., DAVIS. DEPT. OF GOD SCIENCE AND TECHNOLOGY. AND PLAND MANAGEMENT, PAtterns of Drainage Areas With Random Topology. W73-03233 CALIFORNIA UNIV., IRVINE. DEPT. OF GEOGRAPHY. Patterns of Drainage Areas With Random Topology. W73-03075 AW3-03079 AW3-0307	BRISTOL UNIV. (ENGLAND). DEPT. OF CIVIL		Effects of an Artificial Stream on Marine Com-
Management, W73-03022 Sq. Wake Dynamics of Two-Dimensional Structures in Confined Flows, water in Considerations and the Confined Flows, water in Considerations and the Crapina-Jijila Marshy Complex, (in Rumanian), water, water in the Crapina-Jijila Marshy Complex, (in Rumanian), water, water in Confiderations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), water, water in Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), water, water in Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), water, water in Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), water, water in Considerations Regarding Distribution of Distribution and Security of Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), water, water in Considerations Regarding Distribution of Distribution and Security of Considerations Regarding Distribution and Security of Considerations Regarding Distribution and Security of Consideration and Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), water, water, water in Considerations Regarding Distribution and Security of Considerations and Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), water,	Flow-Induced Dynamic Pressures on Square-		
Wake Dynamics of Two-Dimensional Structures in Confined Flows, W73-03024 BRITISH COLUMBIA UNIV., VANCOUVER. Oxygen Transfer to Water and to Sodium Sulfite Solutions, W73-02962 SG BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crapina-Iijila Marshy Complex, (in Rumanian), W73-02686 ZI BUREAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03122 BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO, RADIOLOGICAL ENGINEERING LAB. EVAULation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effluents, W73-03755 BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer Materials—Fourth Topical Report, W73-02844 Concrete-Polymer Materials—Fourth Topical Report, W73-02844 Concrete-Polymer Materials—Fourth Topical Report, W73-02841 Washing CALIFORNIA UNIV., LOS ANGELES. SCHOOL OF PRICINERY IN Services on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment systems, water Studies on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment Systems, water Studies on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment Systems, water Studies on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment Systems, water Studies on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment Systems, water Studies on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment Systems, water Studies on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment Systems, water Studies on the Survival of Pollovirus in Algal-Bacterial Wastewater Treatment Studies on the Survival California Color of Reclaimed Waster, wy3-03-0255 CALIFORNIA UNIV., BERKELEY. SCHOOL OF Pollovirus in Algal-Bacterial Wastewater Treatment Studies of Reclaimed Waster,		Management,	
BRITISH COLUMBIA UNIV., VANCOUVER. Oxygen Transfer to Water and to Sodium sulfite Solutions, WT3-02962 5G BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crapina-Ijijia Marshy Complex, (In Rumanian), WT3-02686 21 BUREAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, WT3-03122 6B BUREAU OF LAND MANAGEMENT, WT3-03122 6B BUREAU OF LAND MANAGEMENT, WT3-03122 6B BUREAU OF LAND MANAGEMENT, WT3-03123 6B BUREAU OF RADIOLOGICAL HEALTH. CINCINNATI, OHIO, RADIOLOGICAL ENGINEERING LAB. EVAILUSION of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, WT3-03753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, WT3-02844 5A Concrete-Polymer Materials-Fourth Topical Report, Concrete-Polymer Materials-Fourth Topical Report, Consideration Segarding Distribution of Poliovirus in Algal-Bacterial Wastewater Treatment Systems, well as Laboratory Studies on the Survival of Poliovirus in Algal-Bacterial Wastewater Treatment Systems, well as Laboratory Studies on the Survival of Poliovirus in Algal-Bacterial Wastewater Treatment Systems, well Stream Properties to Polivary and Properties to Polivary		CALIFORNIA UNIV., BERKELEY. SCHOOL OF	The General Economy.
Poliovirus in Algal-Bacterial Wastewater Treatment Systems, Suffite Solutions, W73-02962 5G BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crapina-lijila Marshy Complex, (in Rumanian). W73-02686 2I BUREAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 6B BUREAU OF LAND MANAGEMENT, W73-03122 6B BUREAU OF LAND MANAGEMENT, W73-03123 6B BUREAU OF LAND MANAGEMENT, W73-03102 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO, RADIOLOGICAL ENGINEERING LAB. EVALUATION of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuctors, W73-0375 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02344 5A Concrete-Polymer Materials-Fourth Topical Report, Poliovirus in Algal-Bacterial Wastewater Treatment Systems, W73-03178 5D CALIFORNIA UNIV., BERKELEY. WATER Relating Kraft Waste Stream Properties to Biochemical Oxygen Demand, W73-02940 ST CALIFORNIA UNIV., DAVIS. DEPT. OF FOOD Swimming Resorts: II (In Japanese), W73-02928 SIRCENCE AND TECHNOLOGY. Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, W73-03122 SIRCENCE AND TECHNOLOGY. Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, W73-03122 SOC. CALIFORNIA UNIV., DAVIS. DEPT. OF SOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-02949 ST CALIFORNIA UNIV., INVINC. DEPT. OF SOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-02945 SCALIFORNIA UNIV., INVINC. DEPT. OF PHARMACEUTICAL SCIENCES. Determination of Total Mercury in Sludge (In Japanese), W73-02946 SCHIBA UNIV. (JAPAN). CHIBA SCH. PRICE Water. W73-02940 ST CALIFORNIA UNIV., DAVIS. DEPT. OF SOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-02945 SCALIFORNIA UNIV., INVINC. DEPT. OF CALIFORNIA UNIV., INVINC. DEPT. OF CALIFORNIA UNIV., SCR. MERCURY. W73-02945 SC		PUBLIC HEALTH.	
Suffite Solutions, W73-02962 BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (in Rumanian), W73-02686 21 BURRAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 6B BURRAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03123 6B BURRAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. EValuation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-03753 5A BURRAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02344 Concrete-Polymer Materials—Fourth Topical Report, Concrete-Polymer Materials—Fourth Topical Report, Considerations Regarding Distribution of Phythical Actitudes Toward Reuse of Reclaimed Water, Public Attitudes Toward Reuse of Reclaimed Maters in Sea Water of California Univ., DAVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY. AND FLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03192 CALIFORNIA UNIV., DAVIS. DEPT. OF SOILS AND FLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03193 AND FLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03193 AND FLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03193 AND FLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03193 AND FLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03193 AND FLANT NUTRITION. Calcium and Salt Tolerati		Poliovirus in Algal-Bacterial Wastewater Treat-	POINT.
BUCHAREST UNIV. (RUMANIA). Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (In Rumanian), W73-02686 21 BUREAU OF LAND MANAGEMENT, Public Land Management in the Arid Southwest, W73-03122 6B BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03123 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO, RADIOLOGICAL ENGINEERING LAB. Evaluation of lon-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-0379 BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer Materials—Fourth Topical Report, CALIFORNIA UNIV., DAVIS, DEPT. OF SOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03193 CALIFORNIA UNIV., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03094 CALIFORNIA UNIV., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03095 Two Models for Horton's Law of Stream Numbers, W73-03079 ANGREE STORAGEMENT, W73-03156 CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY. CALIFORNIA UNIV., LOS ANGELES. CHOOL OF ENGINEERING AND APPLIED SCIENCE. Optimal Operation of Serially-Linked Water Reservoirs, W73-02846 CALIFORNIA UNIV., DAVIS. DEPT. OF SOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03156 CALIFORNIA UNIV., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. California Univ., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03094 CALIFORNIA UNIV., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. California Univ., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. California Univ., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. California Univ., IRVINE. DEPT. OF GOILS AND PLANT NUTRITION. CALIFORNIA UNIV., IRVINE. DEPT. OF GOILS W73-03075 AND PLANT NUTRITION. CALIFORNIA UNIV., IRVINE. DEPT. OF GOILS W73-03162 CEMSON UNIV., S	Sulfite Solutions,	W73-03178 5D	Biochemical Oxygen Demand,
Considerations Regarding Distribution of Phytoplankton in the Crapina-Jijila Marshy Complex, (In Rumanian), W73-02686 21 BUREAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 6B BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-02733 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-02753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chiorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 5A Concrete-Polymer Materials—Fourth Topical Report,	W 73-02982	RESOURCES CENTER.	AND AND A STORE OF THE A TRACK OF THE PARTY.
Complex, (In Rumanian), W73-02686 21 CALIFORNIA UNIV., DAVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY. Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, W73-02779 57 BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03123 68 BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-02753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer Materials—Fourth Topical Report, CALIFORNIA UNIV., LOS ANGELES. SCHOOL OF ENGINEERING AND APPLIED SCIENCE. Optimal Operation of Serially-Linked Water Reservoirs, W73-02844 Concrete-Polymer Materials—Fourth Topical Report, CALIFORNIA UNIV., LOS ANGELES. SCHOOL OF ENGINEERING AND APPLIED SCIENCE. Optimal Operation of Serially-Linked Water Reservoirs, Swimming Resorts: II (In Japanese), W73-03928 Swimming Resorts: II (In Japanese), W73-03928 Swimming Resorts: II (In Japanese), W73-03928 CHIBA UNIV. (JAPAN). FACULTY OF PHARMACEUTICAL SCIENCES. Determination of Total Mercury in Sludge (I Japanese), W73-02945 CLEMSON UNIV., S.C. DEPT. OF ENTOMOLOGY AND ECONOMIC ZOOLOGY. Distribution and Seasonal Occurrence of Tabanidae along a Transect of South Carolina, W73-03156 Some Ecological Notes on Lotic Dipters Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES RESEARCH INST. Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed, W73-02946 COLLEGE OF AGRICULTURE, INDORE (Gossypium hirrutum L.) under Three Sowin Times, Three Row Spacings and Thre Nitrogen Levels in Nimar Tract of Madhy Pradesh.	Considerations Regarding Distribution of	Water,	
BUREAU OF LAND MANAGEMENT, PHOENIX, ARIZ. Public Land Management in the Arid Southwest, W73-03122 6B BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03123 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-02753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer Materials—Fourth Topical Report, CALIFORNIA UNIV., LOS ANGELES. SCHOOL OPT and Internation of Total Mercury in Sludge (I Japanese), W73-02779 SCIENCE AND TECHNOLOGY and Echenology and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, Influence of Temperature on Taste Intensity and Degree of Liking of Degree of Liking Of Degration by Bean Plants, Influence of Temperature on Taste Intensity and Degree of Liking Of Degration by Bean Plants, Influence of Temperature on Taste Intensity and Degree of Liking Of Degration by Bean Plants, Influence of Liking Of Degratio	Complex, (In Rumanian),		Swimming Resorts: II (In Japanese),
FINDERAL OF LAND MANAGEMENT, Public Land Management in the Arid Southwest, W73-03122 6B BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03123 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-0379 4A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 5A Concrete-Polymer Materials—Fourth Topical Report, Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water, W73-02779 SF BUREAU OF LAND MANAGEMENT, W73-02779 ST CALIFORNIA UNIV., DAVIS. DEPT. OF SOILS AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03094 CALIFORNIA UNIV., IRVINE. DEPT. OF GEOGRAPHY. Two Models for Horton's Law of Stream Numbers, W73-03075 Two Models for Horton's Law of Stream Numbers, W73-03079 AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03094 CALIFORNIA UNIV., IRVINE. DEPT. OF ENTOMOLOGY AND ECONOMIC ZCOLOGY. Distribution and Seasonal Occurrence of Tabanidae along a Transect of South Carolina, W73-03156 Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03079 AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03094 CALIFORNIA UNIV., IRVINE. DEPT. OF ENTOMOLOGY AND ECONOMIC ZCOLOGY. W73-03162 Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CEMSON UNIV., S.C. WATER RESOURCES Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES Topology, W73-02647 Emergy Input-Output Climates of the World: A Preliminary Attempt, W73-02846 COLLEGE OF AGRICULTURE, INDORE (INDIA). Performance of Rain			
Southwest, W73-03122 6B BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03193 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-02753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 5A Concrete-Polymer MaterialsFourth Topical Report, Surable Actification by Bean Plants, W73-02945 5. AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-02945 3C AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-02945 5. AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-02945 5. AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-02945 5. CALIFORNIA UNIV., IRVINE. DEPT. OF ENTOMOLOGY AND ECONOMIC ZOOLOGY. Distribution and Seasonal Occurrence of Entomology And Economic Zoology. W73-03156 5. Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 5. Two Models for Horton's Law of Stream Numbers, W73-03079 4A Topology, W73-03079 4A Topology, W73-03079 4A CLEMSON UNIV., S.C. WATER RESOURCES RESEARCH INST. Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed, W73-02946 2. COLLEGE OF AGRICULTURE, INDORE (INDIA). Performance of Rainfed American Cottor (Gossypium hirsutum L.) under Three Sowin Times, Three Row Spacings and Thre Nitrogen Levels in Nimar Tract of Madhy	PHOENIX, ARIZ.	Influence of Temperature on Taste Intensity and Degree of Liking of Drinking Water,	
BUREAU OF LAND MANAGEMENT, WASHINGTON, D.C. Arid Lands and Their Future, W73-03123 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-02753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer MaterialsFourth Topical Report, AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03099 AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03099 AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03099 AND PLANT NUTRITION. Calcium and Salt Toleration by Bean Plants, W73-03099 The Salt Science of South Carolina, W73-03156 Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. DEPT. OF ENTOMOLOGY AND ECONOMIC ZOOLOGY. Distribution and Seasonal Occurrence of Entromology D			
WASHINGTON, D.C. Arid Lands and Their Future, W73-03094 W73-03123 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effuents, W73-02753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer MaterialsFourth Topical Report, CALIFORNIA UNIV., IRVINE. DEPT. OF GEOGRAPHY. Datterns of Drainage Areas With Random Topical Sprainage Areas With Random Topology, W73-031075 Two Models for Horton's Law of Stream Numbers, W73-03079 4A Two Models for Horton's Law of Stream Numbers, W73-03079 4A Two Models for Horton's Law of Stream Numbers, W73-03079 4A CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY. Energy Input-Output Climates of the World: A Preliminary Attempt, W73-02846 CALIFORNIA UNIV., LOS ANGELES. SCHOOL OF ENGINEERING AND APPLIED SCIENCE. Optimal Operation of Serially-Linked Water Random Topical W73-03156 Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03156 Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03156 Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03156 Some Ecological Notes on Lotic Diptera Emergence in Prater's Creek, South Carolina, W73-03156 CLEMSON UNIV., S.C. WATER RESOURCES RESEARCH INST. Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed, W73-02946 COLLEGE OF AGRICULTURE, INDORE (INDIA). Performance of Rainfed American Cotto (Gossypium hirsutum L.) under Three Sowin Times, Three Row Spacings and Thre Nitrogen Levels in Nimar Tract of Madhy	A PROPERTY OF MANY AND A PARTY.	AND PLANT NUTRITION.	CLEMSON UNIV., S.C. DEPT. OF
W73-03123 6B BUREAU OF RADIOLOGICAL HEALTH, CINCINNATI, OHIO. RADIOLOGICAL ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effluents, W73-03753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer MaterialsFourth Topical Reservoirs, Concrete-Polymer MaterialsFourth Topical Reservoirs, W73-02847 ERADIOLORINA UNIV., IRVINE. DEPT. OF GEOGRAPHY. Patterns of Drainage Areas With Random Topology, W73-03075 AA Drainage Areas With Random Topology, W73-03075 AA BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer MaterialsFourth Topical Report, CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY. Energy Input-Output Climates of the World: A Performance of Rainfed American Cotto (Gossypium hirsutum L.) under Three Sowin Times, Three Row Spacings and Thre Nitrogen Levels in Nimar Tract of Madhy Piradesh, W73-02846 CALIFORNIA UNIV., IRVINE. DEPT. OF GEOGRAPHY. Patterns of Drainage Areas With Random Topology, W73-03075 AA Emergence in Prater's Creek, South Carolina, W73-03166 Some Ecological Notes on Lotic Diplera Emergence in Prater's Creek, South Carolina, W73-03166 Colomoral Procedures of Areas With Random Topology, W73-03075 AA Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES RESEARCH INST. Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed, W73-02946 COLLEGE OF AGRICULTURE, INDORE (INDIA). Performance of Rainfed American Cotto (Gossypium hirsutum L.) under Three Sowin Times, Three Row Spacings and Thre W73-02847 Town Models for Horton's Law of Stream Numbers, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES RESEARCH INST. Application of a Digital Hydrologic Simulation of a Digital Hydrologic	WASHINGTON, D.C.	19/72 02004	ENTOMOLOGY AND ECONOMIC ZOOLOGY. Distribution and Seasonal Occurrence of
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ENGINEERING LAB. Evaluation of Ion-Exchange Surveillance Sampler for Analyzing Radioactive Liquid Effluents, W73-02753 5A BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer MaterialsFourth Topical Report, Sampler for Analyzing Radioactive Liquid Effluents, W73-03075 Two Models for Horton's Law of Stream Numbers, W73-03079 4A Two Models for Horton's Law of Stream Numbers, W73-03079 4A Emergence in Prater's Creek, South Carolina, W73-03162 CLEMSON UNIV., S.C. WATER RESOURCES Application of a Digital Hydrologic Simulation Model to an Urbanized Watershed, W73-02946 2D COLLEGE OF AGRICULTURE, INDORE (INDIA). Performance of Rainfed American Cottor (Gossypium hirsutum L.) under Three Sowin Times, Three Row Spacings and Thre Nitrogen Levels in Nimar Tract of Madhy Pradesh,		Patterns of Drainage Areas With Random	Some Ecological Notes on Lotic Dipteran
pler for Analyzing Radioactive Liquid Effluents, W73-02753 BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer MaterialsFourth Topical Report, Two Models for Horton's Law of Stream Numbers, W73-03079 4A CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY. Energy Input-Output Climates of the World: A Performance of Rainfed American Cotto (Cossypium hirsutum L.) under Three Sowin Times, Three Row Spacings and Thre Nitrogen Levels in Nimar Tract of Madhy Pradesh,	ENGINEERING LAB.		
BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Concrete-Polymer MaterialsFourth Topical Report, Solomeria S	pler for Analyzing Radioactive Liquid Ef-	11 ·	CLEMSON UNIV., S.C. WATER RESOURCES
BUREAU OF RECLAMATION, DENVER, COLO. Development of Analytical Procedures for Determining Chlorinated Hydrocarbon Residues in Waters and Sediments From Storage Reservoirs, W73-02844 Toncrete-Polymer MaterialsFourth Topical Report, CALIFORNIA UNIV., LOS ANGELES. DEPT. OF GEOGRAPHY. Energy Input-Output Climates of the World: A Preliminary Attempt, W73-02647 Energy Input-Output Climates of the World: A Preliminary Attempt, W73-02647 2B COLLEGE OF AGRICULTURE, INDORE (INDIA). Performance of Rainfed American Cotto (Gossypium hirsutum L.) under Three Sowin Times, Three Row Spacings and Thre Nitrogen Levels in Nimar Tract of Madhy Pradesh,			RESEARCH INST.
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Residues in Waters and Sediments From Storage Reservoirs, W73-02647 W73-02647 2B (INDIA). Performance of Rainfed American Cotto (Gossypium hirsutum L.) under Three Sowin OF ENGINEERING AND APPLIED SCIENCE. Optimal Operation of Serially-Linked Water Reservoirs, Waters and Sediments From W73-02647 2B (INDIA). Performance of Rainfed American Cotto (Gossypium hirsutum L.) under Three Sowin Optimal Operation of Serially-Linked Water Reservoirs, Witrogen Levels in Nimar Tract of Madhy Pradesh,	Development of Analytical Procedures for	Energy Input-Output Climates of the World: A	
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W73-02845 8F W73-02707 4A W73-03201	W73-02845 8F	W73-02707 4A	W73-03201 3F

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COLLEGE OF ENGINEERING, MADRAS	COMPAGNIE ELECTRO-MECANIQUE, PARIS	Rotational Stability in Dilute Polymer Solu-
(INDIA), DEPT. OF HYDRAULIC ENGINEERING.	(FRANCE). (ASSIGNEE) Centrifugal, Multieffect Distillation Apparatus,	tions, W73-02874 2E
Aeration of Weirs,	W73-02986 3A	
W73-03142 8B	CONNECTICUT UNIV., STORRS.	DEPARTMENT OF ENERGY, MINES AND RESOURCES, BURLINGTON (ONTARIO).
COLORADO STATE UNIV., FORT COLLINS.	BIOLOGICAL SCIENCES GROUP.	CANADA CENTER FOR INLAND WATERS.
Boundary Effects in Desaturation of Porous	Production of Geosmin and 2-Exo-Hydroxy-2-	Isopiestic Determination of Solubilities in
Media,	Methylbornane by Streptomyces odorifer,	Mixed Salt Solutions. Two Salt Systems,
W73-03064 2G	W73-02949 5A	W73-03063 2K
COLORADO STATE UNIV., FORT COLLINS.	CONNECTICUT UNIV., STORRS. DEPT. OF	DEPARTMENT OF ENERGY, MINES AND
DEPT. OF CIVIL ENGINEERING.	CHEMICAL ENGINEERING. Wet Oxidation of Nylon 6,6 by the Rotating	RESOURCES, BURLINGTON (ONTARIO). CANADA CENTRE FOR INLAND WATERS.
Dispersion of Contaminated Bed-Load Parti-	Disk Technique,	Forces on a Submerged Breakwater,
cles, W73-02650 5B	W73-03186 5D	W73-03031 8B
THE RESIDENCE OF THE PARTY OF T	CONNECTICUT UNIV., STORRS. DEPT. OF	DEPARTMENT OF ENERGY, MINES AND
COLORADO STATE UNIV., FORT COLLINS.	CHEMISTRY.	RESOURCES, CORNWALL (ONTARIO).
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Toxicity of Aluminum Hydroxide Complexes in	of Lindane, W73-03185 5G	OFFICE. Great Lakes Simulation ModelA Decision
Neutral and Basic Media to Rainbow Trout,	10/10/16/16/16 Table 16 Table 3 Visual Square T	Aid,
W73-02951 5C	CONNECTICUT UNIV., STORRS. DEPT. OF	W73-03234 2H
COLORADO STATE UNIV., FORT COLLINS.	ELECTRICAL ENGINEERING. A New Data Base for Syntax-Directed Pattern	DEPARTMENT OF FISHERIES AND
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ANTHROPOLOGY.	W73-02885 7C	WATERS BRANCH.
Organizational Aspects of Irrigation Systems, W73-03106	CONNECTICUT UNIV., STORRS. INST. OF	Mathematical Models and their Use in Water Resources Decision-Making,
W/3-03100	WATER RESOURCES.	W73-03237 6A
Organizational Alternatives in Consolidating Ir-	Water Research at the University of Connec-	Systems Assessed to Besident Water Hay and
rigation Systems,	ticut. W73-02631 9A	Systems Approach to Regional Water Use and Demand.
W73-03107 3F	CHEST COMPANY PRODUCTION SHOWING THE PARTY OF THE	W73-03238 6A
COLORADO STATE UNIV., FORT COLLINS.	CORNELL AERONAUTICAL LAB., INC.,	DEPARTMENT OF THE ENVIRONMENT.
ENVIRONMENTAL RESOURCES CENTER.	BUFFALO, N.Y. Project Fog Drops. Part 1: Investigations of	OTTAWA (ONTARIO), INLAND WATERS
An Application of Multi-variate Analysis in	Warm Fog Properties,	BRANCH.
Hydrology, W73-02873 2E	W73-02782 2B	Jet Boat - Tellurometer Technique for Measur-
CASE VIVIENCE AND CASE OF THE	CORNELL, HOWLAND, HAYES AND	ing Streamflow in Large Rivers, W73-02646 7B
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Uptake of Ru106 by Marine Organisms in	W73-02875 5D	perience at Washington, D. C., W73-02862 5G
Aquaria and in the Natural Environment (Ob-	DELAWARE UNIV., NEWARK, DEPT. OF	Tribles and Institute that Substitute A
servations Concernant les Contaminations Ex-	CIVIL ENGINEERING.	DU PONT DE NEMOURS (E. I.) AND CO.,
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W73-02717 5B	W73-02619 5D	Waters,
	DELAWARE UNIV., NEWARK. WATER	W73-02989 5D
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Water (Nouvelles Etudes Sur Les Formes In-	Water Resources Management in Delaware, W73-02622 6B	WILMINGTON, DEL.
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Polymerisation Des Nitratocomplexes Du	The Availability of Ground Water in New Cas- tle County, Delaware,	W73-03008 5D
Nitrosylrut henium En Eau De Mer), W73-02731 5B	W73-02785 4B	DUKE POWER CO., CHARLOTTE, N.C.
	The Availability of County Water in Party	The Terrestrial Radiological Monitoring Pro-
COMMONWEALTH SCIENTIFIC AND	The Availability of Ground Water in Eastern Sussex County, Delaware,	grams at Duke Power Company's Oconee and McGuire Nuclear Stations,
INDUSTRIAL RESEARCH ORGANIZATION,	W73-02805 4B	W73-02735 5B
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Media,	the Dover Area,	Experimental Water Currents,
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W73-02891 5B	to Water Reservoir: II,	N.MEX.
ECOLE POLYTECHNIQUE, MONTREAL	W73-03198 4A	The Nature and Extent of Peat Deposits and
(QUEBEC).	FISHERIES RESEARCH BOARD OF CANADA,	Possible Effects of Peat Mining on Manmade Features and Springs Near Mescalero, New
Theoretical Study on Flap Gate Oscillation,	NANAIMO (BRITISH COLUMBIA). A Survey of Some Possible Effects of Logging	Mexico,
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The Transfer of Water Research Output by the	tion Crystal River Nuclear Plant, W73-02737 5B	Hydrologic Reconnaissance of Big and Little
Environmental Protection Agency,		Soda Lakes, Churchill County, Nevada,
W73-02879 6B	FMC CORP., SAN JOSE, CALIF. (ASSIGNEE) Sewage Treatment System,	W73-03137 7C
ENVIRONMENTAL PROTECTION AGENCY,	W73-02983 5D	Bathymetric Reconnaissance of Big and Little
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W73-02722 5B	of Oak Seedlings,	tionships, W73-03067 5B
Results of Environmental Radioactivity Mea-	W73-03199 2D	and other and the participation of the state
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Air-Fallout-Water (Messwerte der Umwel-	CALIF. PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION.	Probability of Exceeding Capacity of Flood-
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W73-02651 3E	RADIOHYDROMETRIE.	Water Resources,
GEOLOGICAL SURVEY, LAKEWOOD, COLO.	Model Tests to Study Groundwater Flows	W73-03127 5F
Water Resources Data for Colorado, 1971: Part	Using Radioisotopes and Dye Tracers, W73-02838 2F	HIROSHIMA UNIV. (JAPAN). FACULTY OF
1. Surface-Water Records.	W/3-02030	SCIENCE.
W73-02643 7C	GUELPH UNIV. (ONTARIO). DEPT. OF LAND	Determination of A Trace Amount of Cadmium
A New Technique for Estimating Recharge	RESOURCE SCIENCE. A System for the Rapid Analysis of Organic	in Water by Atomic Absorption Spec- trophotometry Combined with Ammonium Pyr-
Using a Digital Model,	Phosphorus in Water Samples or Fractions	rolidine Dithiocarbamate-Methl Isobutyl
W73-02801 4B	from Chromoatographic Columns,	Ketone Extraction Using Large Aqueous
GEOLOGICAL SURVEY, LANSING, MICH.	W73-02968 5A	Phase/Solvent Rati os,
Water for a Rapidly Growing Urban Communi-	GULF COAST WATER HYGIENE LAB.,	W73-02939 5A
ty-Oakland County, Michigan, W73-02804 3D	DAUPHIN ISLAND, ALA.	HOHENHEIM UNIV.,
	Detection of Viruses in Water: A Review of Methods and Application,	STUTTGART-HOHENHEIM (WEST
GEOLOGICAL SURVEY, MENLO PARK, CALIF.	W73-03174 5A	GERMANY), BOTANISCHES INSTITUT UND BOTANISCHER GARTEN.
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ley Area, Santa Cruz and Monterey Counties,	CORNER, N.J. (ASSIGNEE)	Isopiestic Thermocouple Psychrometer Mea-
California, W73-02653 4B	Desalting and Purifying Water by Continuous	surements of Intact and Excised Plant Materi-
	Ion Exchange,	als, W73-03096 7B
GEOLOGICAL SURVEY, PORTLAND, OREG.	W73-02998 3A	
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W73-02660 7C	DIEGO, CALIF.	(FRANCE). Study of the Pollution of the Lagoon at Tahiti
GEOLOGICAL SURVEY, RESTON, VA.	Instruction Manual for Oil Slick Identification by Trace Element Patterns Measured with	by Fecal Germs (In French),
Urban Sedimentation—In Perspective,	Neutron Activation Analysis,	W73-03181 5B
W73-02793 2J	W73-02715 5A	HORTICULTURAL RESEARCH INST.,
GEOLOGICAL SURVEY, WASHINGTON, D.C.	Application of CF252 to the Detection of	SAHARANPUR (INDIA).
Water Resources of the Minnesota River-	Heavy Metals for Pollution Control,	Effects of Irrigation Methods on Growth of
Hawk Creek Watershed, Southwestern Min-	W73-02738 5A	Mango (Mangifera indica L.) Plants, W73-02698 3F
nesota, W73-02663 7C	GULF SOUTH RESEARCH INST., NEW	And African Professional Surface and the Manager
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W73-03090 3F	Concentration of Viruses by Osmotic Ultrafil- tration: A Preliminary Report on the Develop-	Respiration and Waterlogging,
Remote Sensing of Environmental Pollution,	ment of a Model System,	W73-02930 3F
W73-03131 5A	W73-03176 5A	HULL UNIV. (ENGLAND). DEPT. OF
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Map Showing Drainage Basins and Historic	Hawaiian Mangrove Swamp, W73-03205 2I	
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W73-03152 7C	HDR SYSTEMS, OMAHA, NEBR. Improved River Basin Utilization Through	A New Approach to Efficiency Guarantees,
Location of Wells and Test Holes, Hartford	Systems Analysis,	W73-02842 8C
North Quadrangle, Connecticut,	W73-02665 6A	HYDROCOMP INTERNATIONAL, PALO
W73-03153 7C	HEAT TRANSFER RESEARCH, INC.,	ALTO, CALIF.
Sites of Solid-Waste Storage and Liquid-Waste	ALHAMBRA, CALIF.	Application of Hydrologic Simulation to Water
Discharge, Hartford North Quadrangle, Con-	Fouling: The Major Unresolved Problem in	Resources Planning, W73-03236 6A
necticut, W73-03154 7C	Heat Transfer, W73-02775 8B	THE PROPERTY OF THE PROPERTY O
W73-03154 7C		ILLINOIS STATE GEOLOGICAL SURVEY,
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CPORCIA IINIV ATHENS DERT OF	of Citrus and Grapevine Leaves, W73-03192	ILLINOIS UNIV., CHICAGO. COLL. OF
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Development in Georgia, 1946 -1965,	OF AGRICULTURAL BOTANY. Sodium Export From Bean Leaves as Affected	Hydraulic Engineering: A Brief Overview of
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GEORGIA UNIV., ATHENS. DEPT. OF	W73-03073 2I	delication of the second
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Systems: Net Primary Production and Species	OF SOIL SCIENCE.	Environmental Influence on the Pattern of
Diversity of a Successional Blue-Green Algal	Transfer Properties and Friction Coefficients	Plant Communities Along the North Rim of the
Mat, W73-02980 5C	for Salt and Water Flow Through Clays, W73-02829 2G	Grand Canyon, W73-03078
W73-02980 5C	W 13-04829 20	W73-03078 2I

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ILLINOIS UNIV., URBANA. DEPT. OF MINING,	in the Liquid Flow,	INVESTOR COME I REPUBLICA
METALLURGY AND PETROLEUM	W73-03030 8B	IRKUTSKII GOSUDARSTVENNYI UNIVERSITET (USSR), DEPT, OF
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Thermodynamic Analogy of Mass Transport	Channels and Pipes.	Some Blood Characteristics in Black Baikal
Processes in Porous Media,	W73-03041 8B	Gravling Thymallus articus Baicalensis Dvb.
W73-02819 2F	SCATTOOGRA COCKASTOR AND ATTACASTOR COM-	With Reference to the Estimation of the Grow-
Market and the state of the second	Development of Water Resources of a Basin	ing Conditions (In Russian),
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PATHOLOGY.	liarities of Investigation of Practical Irrigation	
Nutrient Status and Mycorrhizal Enhancement	Problems, W73-03226 3F	ISHIKAWAJIMA HEAVY INDUSTRIES CO.
of Water Transport in Soybean,	W73-03226 3F	LTD., TOKYO (JAPAN).
W73-03087	INSTITUT ROYAL DES SCIENCES	General Purpose Program of Plane Stress Anal-
ILLINOIS UNIV., URBANA. DEPT. OF	NATURELLES DE BELGIQUE, BRUSSELS.	ysis by Finite Element Method, and its Appli- cation,
ZOOLOGY.	Studies on the Productivity of the Ponds of	W73-02852 8A
Assimilation of a Wastewater Treatment Plant	Upper Belgium: The Biology of Limnephilus	
Effluent by the Asa Creek-Kaskaskia River	lunatus Curtis (Trichoptera),	ISTITUTO SUPERIORE DI SANITA, ROME
System, Moultrie County, Illinois,	W73-02689 2I	(ITALY).
W73-02887 5C	INSTITUTE OF HYDROTECHNICAL	A Mobile Laboratory for Monitoring Environ-
HI I WAR INTO THE ANA HVDB GOVETENCE	RESEARCH, BUCHAREST (RUMANIA).	mental Pollution (In Italian),
ILLINOIS UNIV., URBANA. HYDROSYSTEMS LAB.	Hydrodynamic Forces Acting on Sonic Oscilla-	W73-03108 5A
Stochastic Analysis of Hydrologic Systems,	tors in Scnic Transmissions (Forces	JAMES COOK UNIV. OF NORTH
W73-03235 2A	hydrodynamiques agissant sur les oscillateurs	QUEENSLAND, TOWNSVILLE (AUSTRALIA).
#15-03235	soniques prevus dans les transmissions	A Numerical Study of the Nonlinear Laminar
ILLINOIS UNIV., URBANA. WATER	soniques),	Regime of Flow in an Idealised Porous Medi-
RESOURCES CENTER.	W73-03056 8B	um.
Microbial Modification of Ground Water,	The state of the s	W73-02825 2F
W73-02602 5B	INSTITUTO MEXICANO DE RECURSOS	
m	NATURALES RENOVABLES, A.C., MEXICO	JOHNS HOPKINS UNIV., BALTIMORE, MD.
Physico-Chemical Limnology and Periphyton in a Warm-Water Stream Receiving Wastewater	CITY. Round Table Meetings on the Deterioration of	CHESAPEAKE BAY INST.
Treatment Plant Effluent.		A Study on the Chemical Behavior of Zinc in
W73-02603 5D	the Environment; Conference (In Spanish). W73-03195 6G	Chesapeake Bay Water Using Anodic Stripping
# 75-02003 3D	W 73-03193	Voltammetry, W73-02783 5B
Relationship of Plant Moisture Status to Irriga-	INSTITUTUL AGRONOMIC, IASI (RUMANIA).	# 13-02163
tion Need in Corn and Soybean Crops,	Contribution to the Knowledge of the Growth	JOINT LABS. OF THE ELECTRIC UTILITIES
W73-02604 2I	of the Maize Root System Under Irrigation	IN THE NETHERLANDS, ARNHEM.
Towns December of Desires in Diles	Conditions,	Electrical Energy, Demand and Supply,
Transport Processes of Particles in Dilute Suspensions in Turbulent Water Flow - Phase	W73-02668 3F	W73-02769 5C
II,	Dynamics of Nitric and Ammonia Nitrogen Ac-	Discharge of Waste Heat,
W73-02605 8B	cumulation in the Soil, in the Interval Between	W73-02770 5C
THE DESIGN TO A STATE THAT I A SOUTH OF STATE	Watering in the Case of Sprinkling and Bed Ir-	# 15-02110 SC
INDIAN AGRICULTURAL RESEARCH INST.,	rigation of Maize,	Air Pollution from Combustion Products,
NEW DELHI. DIV. OF MICROBIOLOGY.	W73-02669 3C	W73-02771 5C
Seed Pelleting in Relation to Nodulation and		
Nitrogen Fixation by Phaseolus aureus L. in a	Investigations on the Development of Some Or-	JYVASKYLA UNIV. (FINLAND). DEPT. OF
Saline Alkali Soil,	namental Wood Species on Eroded Saline Soil	BIOLOGY.
W73-03097 3C	of the Mouth of Jijia-Bahlui Depression, (In	On the Phytoplankton of Waters Polluted by a
INDIAN COUNCIL OF AGRICULTURAL	Rumanian), W73-02680 3C	Sulphite Cellulose Factory, W73-02979 SC
RESEARCH, BELLARY (INDIA). SOUTHERN	H 13-02000	11.5-02515 3C
REGIONAL SOIL CONSERVATION	INSTITUUT VOOR GEZONDHEIDSTECHNIEK	KANSAS STATE UNIV., MANHATTAN. DIV.
RESEARCH SUB-STATION.	TNO, DELFT, (NETHERLANDS).	OF BIOLOGY.
Effect of Lateral Development of Prosopis ju-	Biological Effects of Air Pollution,	The Antibacterial Capabilities of
liflora DC. Roots on Agricultural Crops,	W73-02773 5C	Polyhalogenated Ion Exchange Resins,
W73-03101 3F	SHEARA MENT O BARK CALLE	W73-03187 5F
INDIAN INST. OF TECH. KANPUR, U.P., DEPT.	INTASA, MENLO PARK, CALIF. A Computer Simulation Model for Flood Plain	The Use of Quaternary Ammonium Resin-
OF CIVIL ENGINEERING.	Development, Part 1: Land Use Planning and	Triiodide Complex to Inactivate Virus and
Accelerated Motion of a Sphere in an Oscillat-	Benefit Evaluation,	Selected Bacteria,
ing Fluid.	W73-02944 4A	W73-03188 5F
W73-03028 8B		
	IOWA COOPERATIVE WILDLIFE RESEARCH	KANSAS STATE UNIV., MANHATTAN. INST.
INDIAN INST. OF TECH., KHARAGPUR.	UNIT, AMES.	FOR SYSTEMS DESIGN AND OPTIMIZATION.
Influence of Shape of Implements on Soil	Pre-Impoundment Boating Activity in the	Compilation of Water Quality Data and Parameters from Kansas Rivers and Streams.
Structure,	Saylorville Reservoir Area,	
W73-03203 2G	W73-02912 6B	W73-02973 5A
INDIAN INST. OF TECH., KHARAGPUR. DEPT.	IOWA INST. OF HYDRAULIC RESEARCH,	KANSAS UNIV., LAWRENCE. DEPT OF CIVIL
OF CIVIL ENGINEERING.	IOWA CITY.	ENGINEERING.
Brink Depth for Trapezoidal Broad-Crested	Extension of the Flow-Net Method to Un-	Modeling Discharge and Conservative Water
Weir,	steady Internal and External Flows,	Quality in the Lower Kansas River Basin,
W73-02788 8B	W73-03027 8B	W73-02658 4A

MISSOU CENTE A N Comp Physi W73-

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KARLSRUHE UNIV. (WEST GERMANY).

(ARLSRUHE UNIV. (WEST GERMANY). NSTITUT FUER	MAHARAJA SAYAJIRAO UNIV. OF BARODA (INDIA).	MICHIGAN STATE UNIV., HICKORY CORNERS. DEPT. OF BOTANY AND PLANT
MEDLUNGSWASSERWIRTSCHAFT. A Branch-And-Bound Algorithm for Regional	On Stabilization of Fingers in a Slightly	PATHOLOGY. A C-14 Assay for Photorespiration in Aquati-
Water Quality Management,	Cracked Heterogeneous Porous Medium, W73-02830 2G	Plants, A TELO AMARINO AVINU MOMENT
W73-03243 5G	MAINE UNIV., BANGOR. WATER RESOURCES	W73-02978
ABORATOIRE NATIONAL D'HYDRALIQUE, CHATOU (FRANCE).	CENTER. Annual Report of Activities During Fiscal Year	MICHIGAN UNIV., ANN ARBOR. Environmental Dynamics of Mercury,
Natural Vibrations of Cylindrical Shells in a Moving Fluid (Vibrations propres de coques	1972. W73-02630 9A	W73-02729 51
cylindriques en presence de fluide), W73-03048 8B	MANCHESTER UNIV. (ENGLAND). DEPT. OF	A Methodology for Estimating the Benefits to Irrigated Agriculture from Increased Accuracy
A Method Utilizing an Integral Formulation of	CIVIL ENGINEERING. Vertical and Horizontal Laboratory Permeabili-	in Seasonal Streamflow Forecasts, W73-03130
Problems of Natural Vibrations of Shells in the Presence of an Incompressible Fluid (A propos d'une methode utilisant une formulation in-	ty Measurements in Clay Soils, W73-02833 2G	MICHIGAN UNIV., ANN ARBOR. BIOLOGICAL STATION.
tegrale du probleme des vibrations propres de coques en presence d'un fluide incompressi-	MANCHESTER UNIV. (ENGLAND). SIMON ENGINEERING LABS.	Future Environments of Arid Lands of Southwestern States,
ble),	The Flow of Air and Water in Partly Saturated	W73-03119
W73-03051 8B	Clay Soil, W73-02834 2G	MICHIGAN UNIV., ANN ARBOR. SCHOOL OF
Damping of Natural Vibrations of an Immersed Cylindrical Shell with Free Ends: Influence of	MANHATTAN COLL., BRONX, N.Y. DEPT. OF	PUBLIC HEALTH. Systems Approach to Problems of Water Pollution Control.
Confinement of the Fluid by an Axial Shell (Amortissement des vibrations propres d'une	CIVIL ENGINEERING. Systems Analysis and Water Quality Manage-	W73-03222
coque cylindrique immergee et libre a ses deux extr emites: influence du confinement du fluide	ment, W73-02943 5G	MIDDLESEX HOSPITAL MEDICAL SCHOOL, LONDON (ENGLAND).
par une coque axiale), W73-03052	MASSACHUSETTS INST. OF TECH.,	The Poison Chain for Mercury in the Environ
W78-020M-season	CAMBRIDGE.	ment, W73-03202
EEDS UNIV. (ENGLAND), DEPT. OF	Community Values: A Strategy for Project Planning,	
Fine Structure of Swarmers of Cladophora and Chaetomorpha. III. Wall Synthesis and	W73-02854 6B	MINNESOTA UNIV., MINNEAPOLIS. Observations and Other Characteristics of
Development,	MASSACHUSETTS INST. OF TECH.,	Thermals, W73-02757
W73-02966 5C	CAMBRIDGE. DEPT. OF CIVIL ENGINEERING.	MINNESOTA UNIV., MINNEAPOLIS. DEPT. O
EHIGH UNIV., BETHELEHEM, PA. DEPT. OF TVIL ENGINEERING.	Gravitational and Dispersive Mixing in Aquifers,	GEOLOGY AND GEOPHYSICS. On the Correlation of Electrical Conductivit
Hydrodynamic Wave Uplift Forces on Horizontal Slabs,	W73-02791 2F	Properties of Porous Systems with Viscou
W73-03034 8B	META SYSTEMS, INC., CAMBRIDGE, MASS. Some Characteristics and Applications of	Flow Transport Coefficients, W73-02822
EHIGH UNIV., BETHLEHEM, PA. DEPT. OF	Mathematical Programming Models in Water	MINNESOTA UNIV., ST. PAUL. DEPT. OF
Drag Coefficient and Turbulence Charac-	Resource Systems, W73-03232 6A	ENTOMOLOGY, FISHERIES AND WILDLIFE. Effects of Hydrogen Sulfide on Fish Eggs an
teristics, W73-03023 8B	METROPOLITAN WATER BOARD, LONDON	Fry, W73-03164 50
ATTLE (ARTHUR D.), INC., CAMBRIDGE,	(ENGLAND). Thermal Stratification and Thermocline Control	MINNESOTA UNIV., ST. PAUL. DEPT. OF
AASS.	in Storage Reservoirs,	HORTICULTURAL SCIENCE.
Economic Impact of Anticipated Paper Indus- try PollutionAbatement Costs, Part I: Execu-	W73-02777 5B	The Influence of Mist Irrigation on the Potat I. Micro-Environment and Leaf Water Rela
tive Summary. W73-02941 5G	Control of Thermal Stratification in Thames Valley Reservoirs,	tions,
WHEN ALL THE ATTEMPT OF THE STATE OF THE STA	W73-02778 5B	W73-02888
JUBLJANA UNIV. (YUGOSLAVIA). DEPT. OF IVIL ENGINEERING.	MIAMI CONSERVANCY DISTRICT, DAYTON.	MINNESOTA UNIV., ST. PAUL. DEPT. OF SOIL
Forces Exerted on Small Structures by a Fluid	OHIO.	SCIENCE. Effect of an Asphalt Barrier on Water Redir
with a Free Surface in Alternating Movement (efforts exerces par un fluide a surface libre en mouvement alternatif sur des structures fines).	The Miami Conservancy District Experience in the Systems Approach to Water Quality Im- provement,	tribution after Infiltration in Sandy Soils, W73-03189
W73-03039 8B	W73-03225 5G	MISSOURI UNIV., COLUMBIA. DEPT. OF
OS ALAMOS SCIENTIFIC LAB., N. MEX.	MIAMI UNIV., CORA GABLES, FLA.	AGRICULTURAL ECONOMICS. Public Water Supply Districts: Evaluation of
Environmental Monitoring in the Vicinity of the Los Alamos Scientific Laboratory, July	An Economic Inventory of the Miami Riyer and Its Economic and Environmental Role in	New Institution, W73-02918
through December 1971. W73-02719 5B	Biscayne Bay, W73-02923 4A	MISSOURI WATER RESOURCES RESEARCH
OS ANGELES DEPT. OF COUNTY	MICHIGAN STATE UNIV., EAST LANSING.	CENTER, COLUMBIA.
INGINEER, DOWNEY, CALIF. SANITATION	DEPT. OF MICROBIOLOGY AND PUBLIC HEALTH.	The Preparation and Oxidative Properties of Ferrate Ion (FeO42-). Studies Directed Towar
'Apollo County Park', Waste Water Reclama- tion Project for the Antelope Valley Area, Los	The Occurrence and Possible Source of the Coliform Bacteria on the Shoreline of Northern	Its Use as a Water Purifying Agent, W73-02608
Angeles County.	Lake Michigan,	Mercury Pollution of Golf Course Lakes,
W73-02867 5D	W73-02606 5B	W73-02615

MISSOURI WATER RESOURCES RESEARCH CENTER, ROLLA.	NATIONAL MARINE FISHERIES SERVICE, SERVICE, SEATTLE, WASH. BIOLOGICAL LAB.	Analysis of the Effects on Oil Spills of Fue Policy Changes and the Addition of Anothe
A New Approach for Water Reclamation - Complete Treatment of Waste Water by	Estimates of Maturation and Ocean Mortality	Fuel Pier with the Aid of a Computer Simula tion Model,
Physico-Chemical Processes, W73-02607 5D	for Columbia River Hatchery Fall Chinook Sal- mon and the Effect of No Ocean Fishing on	W73-02908
MOBILE OIL CORP., NEW YORK. (ASSIGNEE)	Yield,	The Containment and Recovery of Navy O
Removal of Dissolved Oxygen from Water, W73-02988 5D	W73-02927 81 NATIONAL OCEANIC AND ATMOSPHERIC	SpillsA Financial Analysis, W73-02909 56
MONTANA WATER RESOURCES BOARD,	ADMINISTRATION, MIAMI FLA. ATLANTIC	Location and Equipment for Oil Recover
HELENA.	OCEANOGRAPHIC AND METEOROLOGICAL LABS.	Teams in San Diego, W73-02910 50
River Basin Modeling, an Approach to Com- puter Simulation of the Bitterroot-Clark Fork	Palaeotemperature and Cohesion in Globigerina Ooze Sediment Cores From the Caribbean Sea.	
River Basin. W73-02857 4A	W73-02797 2J	NAVAL WEAPONS CENTER, CHINA LAKE, CALIF.
MONTGOMERY (JAMES M.) CONSULTING	NATIONAL PARKS AND CONSERVATION	Project Foggy Cloud III, Phase 1,
ENGINEERS, INC., PASADENA, CALIF.	ASSOCIATION, WASHINGTON, D.C. Ecological River Basin Management,	W73-03145
Water for Southern Nevada, W73-02848 6D	W73-03092 6E	Gromet IIRainfall Augmentation in the Philip
THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	NATIONAL SOIL SERVICES, INC., HOUSTON,	pine Islands, W73-03149
MOSCOW STATE UNIV. (USSR). FACULTY OF BIOLOGY AND SOIL SCIENCE.	TEX; AND SAN ANTONIO CITY PUBLIC	
Relations Between Biomass and Species Diver-	SERVICE BOARD, TEX. Internal Piping and Shear Deformation Victor	NEBRASKA UNIV., LINCOLN. WATER RESOURCES RESEARCH INST.
sity in Marine and Freshwater Zooplankton Communities,	Braunig Dam - San Antonio, Texas,	Technology Transfer in Water ResearchTh
W73-02967 5C	W73-03250 8D	Interface Between Producers and Users. W73-02877 6
MOSKOVSKII INZHENERNO-STROITELNYI	NATIONAL WATER QUALITY LAB., DULUTH,	W 73-02877
INSTITUT (USSR).	MINN. Changes in the Blood of the Brown Bullhead	NEW HAMPSHIRE UNIV., DURHAM, DEPT.
Moment Characteristics of Cascades Under Nonstationary Flow Conditions,	(Ictalurus nebulosus (Lesueur)) Following	OF MICROBIOLOGY. Biologic Parameters in Water Transmission
W73-03029 8B	Short and Long Term Exposure to Copper (II), W73-02947 5C	Viruses,
MOUND LAB., MIAMISBURG, OHIO.	OUTO COOKERVILLE ACTOR AS COLUMN SALES	W73-03173
Bibliography on Handling, Control and Moni- toring of Tritium (Dec. 1968-Jan. 1972),	Culture of the Yellow Perch in the Laboratory, W73-02952 5G	NEW HAMPSHIRE UNIV., DURHAM. WATER RESOURCES RESEARCH CENTER.
W73-02708 5B	Successful Sparining of Largemouth Dass,	A Six-Year Review.
Environmental Monitoring Report: July- December 1971 and 1971 Summary,	Micorpterus salmoides (Lacepede) Under Laboratory Conditions,	W73-02655 9
W73-02709 5B	W73-02953 5G	NEW MEXICO AGRICULTURAL EXPERIMENT STATION, UNIVERSITY PARK
NALCO CHEMICAL CO., CHICAGO, ILL. (ASSIGNEE).	Culture, Reproduction, and Temperature Tolerance of Pontoporeja affinis in the Labora-	Soil Associations and Land Classification for Irrigation, Lincoln County,
Removal of Phosphates from Sewage Effluent,	tory, W73-03168 5C	W73-02623
W73-03000 5D		NEW MEXICO INST. OF MINING AND
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD.	NAUCHNO-ISSLEDOVATELSKII INSTITUT GIGIENY, MOSCOW (USSR). Experimental Substantiation of the Maximal	TECHNOLOGY, SOCORRO. Specific Capacities of Wells in Crystallin
GODDARD SPACE FLIGHT CENTER. Nimbus 3 and 4 Observations of Snow Cover	Permissible Content of Pentaerythritol and	Rocks,
and Other Hydrological Features in the	Xyutoi in Water Bodies, (In Russian),	W73-02800
Western Himalayas, W73-03134 7B	Principle and American Management of the Control of	NEW MEXICO STATE UNIV., UNIVERSITY
	NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.	PARK. DEPT. OF BIOLOGY. A Land-Use Plan for the Arid Southwest,
NATIONAL ASSOCIATION OF COUNTIES RESEARCH FOUNDATION, WASHINGTON,	Immediate Cost-Effective Abatement of Water Pollution from Navy Ships.	W73-03120
D.C. Water and Our Future: An Urban Planning	W73_02901 5G	NEW MEXICO STATE UNIV., UNIVERSITY
Manual for Local Officials,	Shipboard Control of Wastes,	PARK. DEPT. OF CIVIL ENGINEERING.
W73-02872 6B	W73-02902 5G	Agricultural Wastes in Arid Zones, W73-03128
NATIONAL ENVIRONMENTAL SATELLITE	Toxicity and Spreading of Oil in Sea Water,	
CENTER, WASHINGTON, D.C. Remote Sensing of Sea Ice from Earth Satel-	W73-02903 5G	NEW MEXICO STATE UNIV., UNIVERSITY PARK. DEPT. OF PHYSICS.
lites,	The Vertical Movement of Oil in Seawater and	Cloud Chamber Design for Water Evaporation
W73-02645 7B	the Aging of Oil Slicks, W73-02904 5G	Studies, W73-02889
NATIONAL ENVIRONMENTAL SATELLITE	Journal Cornell Chargest Strains	
SERVICE, WASHINGTON, D.C. Remote Sensing of Snow Fields from Earth	Characterization and Treatment of Bilge and Ballast Water,	An Expansion Cloud Chamber Study of Wat
Satellites,	W73-02905 5G	Evaporation, W73-02890
W73-03133 7B	Oil Spill Characteristics and Statistics,	
NATIONAL INST. OF OCEANOGRAPHY,	W73-02906 5G	NEW MEXICO STATE UNIV., UNIVERSITY PARK. WATER RESOURCES RESEARCH INS
WORMLEY (ENGLAND). Slumping on the Eastern Margin of the Rockall	Reduction of Oil Spills During Shipboard Fuel	Bioassays of Quality in Water Resources
Bank, North Atlantic Ocean,	Movement Evolutions,	Major Importance to New Mexico,

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NEW SOUTH WALES STATE FISHERIES,	Inventory of Active Water Resources Research	OREGON STATE UNIV., CORVALLIS. DEPT.
SYDNEY (AUSTRALIA). The Biology of a Landlocked Form of the Nor-	Projects in North Carolina. W73-02629 9D	OF GENERAL SCIENCE.
mally Catadromous Salmoniform Fish Galaxias	W 73-02029 9D	Radionuclide Cycling in Natural Populations of Amphibians. Annual Progress Report, June 16,
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W73-02855 21	BUSINESS ADMINISTRATION, BERGEN. Discount Rates for Public Investment Under	W73-02755 SC
The Biology of a Landlocked Form of the Nor-	Uncertainty,	OREGON STATE UNIV., CORVALLIS. DEPT.
mally Catadromous Salmoniform Fish Galaxias Maculatus (Jenyns): II. Morphology and Syste-	W73-02942 6B	OF MICROBIOLOGY. Solubilization of inorganic phosphate by bac-
matic Relationships.	NUCLEAR FUEL SERVICES, INC., WEST	teria isolated from upper Klamath Lake sedi-
W73-02856 2I	VALLEY, N.Y.	ment,
NEW YORK OPERATIONS OFFICE (AEC), N.Y.	West Valley Reprocessing Plant. Environmen- tal Report No. 11, 2nd Half 1971,	W73-02954 5C
Environmental Radiation Dosimetry Near Large Nuclear Power Stations,	W73-02712 5B	OREGON STATE UNIV., CORVALLIS. DEPT.
W73-02742 5B	OAK RIDGE NATIONAL LAB., TENN.	OF OCEANOGRAPHY. Radioactive and Stable Nuclides in the Colum-
NEW YORK STATE DEPT. OF	Biological Aspects of Thermal Pollution, II. Scientific Basis for Water Temperature Stan-	bia River and Adjacent Northeast Pacific
ENVIRONMENTAL CONSERVATION,	dards at Power Plants,	Ocean, W73-02745 5B
ALBANY.	W73-02766 5C	W73-02745 5B
Environmental Radioactivity Measurement Ex-	Effect of Brine Disposal Cost on Hyperfiltra-	Diel Periodicity of Chlorophyll a Concentration
perience Near a Fuels Reprocessing Plant, W73-02741 5B	tion Plant Optimization,	in Oregon Coastal Waters,
THE RESIDENCE AND DEAL PROPERTY OF THE PROPERT	W73-02914 5E	W73-02970 5C
NEW YORK STATE DEPT. OF	Comment of the Manager Beauty Indiana	OREGON STATE UNIV., EUGENE. SCHOOL
ENVIRONMENTAL CONSERVATION, ALBANY, BUREAU OF WATER RESOURCES	Survey of the Mercury Reprocessing Industry, 1968-1970.	OF LAW.
PLANNING.	W73-02931 5G	Adjudication Provisions Under the 1909 Water
Flood Control Storage Allocations by Linear	OFFICE OF SALINE WATER, WASHINGTON,	CodeSurvey of Case Law and Proposals for Legislative Amendment,
Programming, W73-02667 4A	D.C.	W73-02894 6E
W13-02001	Desalting as a Source of Water Supply,	ORGANISATIE VOOR TOEGEPAST
NEW YORK STATE DEPT. OF	W73-02861 3A	NATUURWETENSCHAPPELIKJ ONDERZOEK,
ENVIRONMENTAL CONSERVATION, ALBANY, ENVIRONMENTAL QUALITY	OHIO COOPERATIVE WILDLIFE RESEARCH	THE HAGUE (NETHERLANDS). (ASSIGNEE)
RESEARCH AND DEVELOPMENT UNIT.	UNIT, COLUMBUS.	Activated Sludge Processing,
A Computer Program for Calculating Nutrient	Exploitation of Crayfish by Largemouth Bass	W73-02981 5D
Balances,	in a Small Ohio Pond, W73-02704	OSAKA PREFECTURE (JAPAN). (ASSIGNEE)
W73-02858 7C	W73-02704 8I	Process of Purifying Water by Irradiating It,
Sources of Nutrients in Canadarago Lake,	OKLAHOMA STATE UNIV., STILLWATER.	W73-02982 5D
W73-02859 5C	DEPT. OF AGRICULTURAL ECONOMICS. An Economic Analysis of Water-Use Regula-	OSAKA UNIV. (JAPAN). DEPT. OF BIOLOGY.
NEW YORK UNIV., N.Y. INST. OF	tion in the Central Ogallala Formation,	A Physiological Study on Variations of Dry
ENVIRONMENTAL MEDICINE.	W73-02892 4B	Matter Percent of Tuber in Sweet Potatoes (In
Environmental Sampling for River Sediments	OKLAHOMA UNIV., NORMAN. DEPT. OF	Japanese),
Around a Nuclear Power Station, W73-02740 5B	ZOOLOGY.	W73-02692 3F
The same of the sa	Surface Phytoplankton and Some Aspects of	OULU UNIV. (FINLAND). DEPT. OF BOTANY.
NEWCASTLE-UPON-TYNE UNIV. (ENGLAND).	the Physical-Chemical Limnology of Three	The Water Economy of the Bilberry (Vaccini-
DEPT. OF GEOGRAPHY. The Effects of Water Availability on Tea	Areas on Lake Texoma, W73-03072 2H	um myrtillus) Under Winter Conditions, W73-02705 21
Yields in Uganda,	A A STATE OF THE S	W73-02705 2I
W73-02696 3F	OKLAHOMA WATER RESOURCES	PAHLAVI UNIV., SHIRAZ (IRAN). COLL. OF
NORTH CAROLINA STATE UNIV., RALEIGH.	RESEARCH CENTER, STILLWATER. Identification of Toxic Components in Oil	AGRICULTURE.
Non-Steady Flow on Sloping Beach with Large	Refinery Effluents and Determination of Their	Salt Tolerance of Safflower Varieties (Carthamus tinctorius L.) During Germination,
Roughness Elements,	Effect Upon the Aquatic Biota,	W73-03088 3C
W73-03040 2E	W73-02609 5A	BARIE HINTO THOUGH I BE BATHE OF ANCH
The Impact of Water Development on the	OREGON AGRICULTURAL EXPERIMENT	PARIS UNIV., THONON-LES-BAINS (FRANCE). CENTER FOR GEODYNAMIC RESEARCH.
Ecology of Bays and Estuaries,	STATION, CORVALLIS.	Tritium in Investigation of Surface Hydrology.
W73-03069 5B	Multi-Disciplinary Study of Water Quality Relationships: A Case Study of Yaquina Bay,	Experimental Determination of Coefficient of
NORTH CAROLINA STATE UNIV., RALEIGH.	Oregon,	Runoff,
DEPT. OF ECONOMICS.	W73-02921 5C	W73-02713 5B
Surcharges and Stream Charges as Economic Incentives.	OREGON STATE UNIV., CORVALLIS. DEPT.	PASSAVANT-WERKE, MICHELBACK (WEST
W73-03190 5G	OF CIVIL ENGINEERING.	GERMANY). MICHELBACHERHUTTE.
	Bed-Load Transport in Mountain Streams,	(ASSIGNEE) Aerating Apparatus,
NORTH CAROLINA UNIV., CHAPEL HILL. Perspectives and Goals for Water Resource	W73-02893 2J	W73-02984 5D
Planning,	Virus-Sized Particle Adsorption on Soil-Part I:	Satisfact.
W73-03182 6B	Rate of Adsorption,	PENNSYLVANIA DEPT. OF ENVIRONMENTAL
NORTH CAROLINA WATER RESOURCES	W73-03177 5B	RESOURCES, HARRISBURG, BUREAU OF SANITARY ENGINEERING.
RESEARCH INST., RALEIGH.	Environmental Planning and Ecological Possi-	Systems Approach to Water Pollution Control -
Annual Report FY 1972.	bilities,	A Discussion,
W73-02628 9A	W73-03184 6G	W73-03224 5G

PENNSYLVANIA STATE UNIV., UNIVERSITY	QUEEN MARY COLL., LONDON (ENGLAND).	ROYAL NETHERLANDS METEOROLOGICAL
PARK. INST. FOR RESEARCH ON LAND AND WATER RESOURCES.	DEPT. OF ZOOLOGY AND COMPARATIVE PHYSIOLOGY.	INST., DE BILT. A Method for Calculating the Size of Cooling
A Water Supply-Demand Analysis in Clinton	The Influence of Thermal Acclimation on the	Tower Plumes,
County, Pennsylvania: A Study in Economic	Relation Between Oxygen Consumption and	W73-02763 5G
Hydrology,	Temperature in Littorina littorea (L.) and Myti-	
W73-02610 6D	lus edulis L.,	RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J.
The Use of Aquatic Plants in the Rehabilitation	W73-02760 SC	Literature Review: Economics,
of Acid Polluted Streams,	REACTOR CENTRUM NEDERLAND, PETTEN.	W73-02934 5G
W73-02611 5G	Environmental Effects Specific to Nuclear	the little and the last the last the last
A Comparison of Public and Resource Ad-	Power Production,	SACLANT ASW RESEARCH CENTRE, LA
ministrator Visual Perceptions of an Outdoor	W73-02774 5C	SPEZIA (ITALY). The Relationship Between the Physical Proper-
Water-Based Recreation Area,	READING UNIV. (ENGLAND). DEPT. OF	ties of Underwater Sediments That Affect Bot
W73-02612 6B	GEOPHYSICS.	tom Reflection,
PENNSYLVANIA UNIV., PHILADELPHIA.	The Decay and Stability of Internal Wave	W73-02798 2
On the Possibility of a Market for Externalities,	Modes in a Multisheeted Thermocline,	SAN DIEGO STATE COLL., CALIF.
W73-02933 6B	W73-02759 5G	Temperature Sensitivity of Two Species of In
	RESEARCH A.B., SYNDBYBERG (SWEDEN).	tertidal Fishes.
PHILADELPHIA SUBURBAN WATER CO.,	(ASSIGNEE)	W73-02762 50
BRYN MAWR. PA. The Coming Technical Revolution in Meter	Process and a Product for the Purification of	
Reading,	Polluted Water from Heavy Metal Ions Present	SASKATCHEWAN-NELSON BASIN BOARD,
W73-02863 7B	Therein,	REGINA. Multireservoir Analysis Techniques in Wate
	W73-02992 5D	Quantity Studies,
PLANT PROTECTION RESEARCH INST.,	RHODE ISLAND UNIV., KINGSTON.	W73-02664 4/
PRETORIA (SOUTH AFRICA). A Laboratory Study on the Toxicity of Dieldrin	The Use of Electrical Resistivity to Determine	
to Fresh Water Invertebrates,	Porosity of Marine Sediments,	Preliminary Analysis of Surface Water Availa
W73-02695 5C	W73-03141 2J	bility, W73-03233
		W /3-03233
POLISH ACADEMY OF SCIENCES, KRAKOW.	RHODE ISLAND UNIV., KINGSTON. DEPT. OF	SAVANNAH RIVER ECOLOGY LAB., AIKEN,
ZAKLAD BIOLOGII WOD. Peculiarities of the Phytoplankton Species	CIVIL AND ENVIRONMENTAL ENGINEERING.	S.C.
Composition of Some Forest Ponds,	Groundwater Flow in Partially Saturated Soils,	A Simple Technique for Detecting Effects o
W73-02644 2I	W73-02624 5B	Toxicants or Other Stresses on a Predator-Pre- Interaction.
	VIII SOURCE CONTRACTOR OF THE SOURCE CONTRACTO	W73-03161 50
The Influence of Herbicide 2,4-D-NA on	RHODE ISLAND UNIV., KINGSTON. DEPT. OF	***************************************
Respiration and Survival of Simocephalus vetu-	MECHANICAL ENGINEERING AND APPLIED MECHANICS.	SECRETARY OF THE INTERIOR,
lus (O.F. Muller) (Cladocera),	Diffusion of Thermally Buoyant Water Jets	WASHINGTON, D.C. (ASSIGNEE)
W73-03166 5C	into a Moving Water Stream,	Neutralization of Ferrous Iron-Containing Aci
BOT TOTAL OTTOGRAM TOTAL TOTAL	W73-02627 5B	Wastes, W73-02993 51
POLITEKNICHESKII INSTITUT, LENIGRAD (USSR).	SHORE OF AND COMM. PROCESSAN WARREN	The second of th
Mechanical Action of Non-Stationary Flow of	RHODE ISLAND UNIV., KINGSTON. WATER RESOURCES CENTER.	Limestone Neutralization of Dilute Acid Wast
Water on Porous Bodies and Through Struc-	Periphyton and Phytobenthon as Indicators of	Waters, W73-02994 51
tures,	Water Quality,	W 73-02994 31
W73-03042 8B	W73-02625 5B	Neutralization of Ferrous Iron-Containing Aci
PURDUE UNIV., LAFAYETTE, IND.	Charles and the state of the Plantage	Wastes,
Taxation and Pollution-Some Comments,	Chemical and Physical Factors in the Floccula-	W73-02995 51
W73-02935 5G	tion of Metal Plating Wastes with Polyelec- trolytes,	Removal of Nitrogen and Phosphorus from
Nitrate Transformations in Surface Waters; I.	W73-02626 5D	Waste Waters,
A Study of Various Factors Affecting the Rates		W73-03002 51
of Denitrification and Immobilization in Sur-	RHODE ISLAND UNIV., PROVIDENCE. DEPT.	SUPPRINCIPLE INTO ALIBERT
face Waters, and II. Characterization of the	OF MECHANICAL ENGINEERING AND APPLIED MECHANICS.	SHERBROOKE UNIV. (QUEBEC).
Surface Waters in the Wabash River and Three	Turbulent Thermal Diffusion of a Slot Jet	A Rapid Grain Size Analysis Method, W73-03249
Farm Ponds,	Flowing into a Moving Stream,	W 13-03249
W73-03191 5B	W73-02895 5B	SHERBROOKE UNIV. (QUEBEC). DEPT. OF
PURDUE UNIV., LAFAYETTE, IND. DEPT. OF	NAME OF THE PARTY	CIVIL ENGINEERING.
AGRICULTURAL ECONOMICS.	RIJKSINSTITUUT VOOR ZUIVERING VAN AFVALWATER, VOORBURG	Trajectory of Floating Bodies in a Strongl Deviating Fluid Vein, (Trajectoire de corp
Economic Efficiency Vs. Environmental Quali-	(NETHERLANDS).	flottants dans une veine fluide fortemen
ty in Small Watershed Development,	Biological Effects of Cooling Water Discharge,	device),
W73-02936 4D	W73-02772 5C	W73-03035 8
PURDUE UNIV., LAFAYETTE, IND. DEPT. OF		
HYDRAULIC ENGINEERING.	ROBERT S. KERR WATER RESEARCH	SHIVAJI COLL., NEW DELHI (INDIA). Germination Behaviour of a Weed and Three
Some Extensions of Linear Systems Analysis	CENTER, ADA, OKLA. Control of Mercury Pollution in Sediments.	Related Crop Plants Under Various Condition
in Hydrology, W73-02662 2A	W73-02632 5G	of Soil Water Content and Temperature,
W73-02662 2A		W73-02673 3
PURDUE UNIV., LAFAYETTE, IND. SCHOOL	ROFE, KENNARD AND LAPWORTH,	COMON CARVES I EN CHOCKBORT
OF CIVIL ENGINEERING.	LONDON, (ENGLAND).	SIMON-CARVES LTD., STOCKPORT (ENGLAND). (ASSIGNEE).
The Frequency of Oscillating Forces Acting on	Examples of the Internal Condtions of Some Old Earth Dams,	Desalination,
Bluff Cylinders in Constricted Passages, W73-03025 8B	W73-02841 8A	W73-03005 · 3

ORGANIZATIONAL INDEX

TEXAS / DEPT. O Integri ty of U W73-0

System of Wa W73-0

TEXAS
DEPT. C
The li
Upon
Leave
W73-4
An E
tion b
W73-

TEXAS DEPT. SCIENC Comty, W73

TEXAS WATE The Faus W73

Wat W73

(ASSIGNATION W7:

TOKY

ENGI UNIV REGI An Cor W7

TORE PHYS

TOU MEC Lo an ob W TRW Re W TSE EKC INS' O Ir

UNI AU' AU' E

SIMON-CARVES LTD., STOCKPORT (ENGLAND). (ASSIGNEE).

Separator-Melter Unit for Desalination,		Zygophyllum coccineum L. Seeds During Ger-
W73-03012	On the Derivation of a Convective-Dispersion	mination, W73-03116 2I
SLOVENSKA AKADEMIE VIED, BRATISLAVA (CZECHOSLOVAKIA). USTAV HYDROLOGIE	Equation by Spatial Averaging, W73-02832 2F	TEL AVIV UNIV. (ISRAEL). DEPT. OF BOTANY.
A HYDRAULIKY. The Magnitude of Shear Stresses Acting on the Bottom of Open Channels by Propagating	STATE UNIV. OF NEW YORK, STONY BROOK. DIV. OF BIOLOGICAL SCIENCES.	Variations in Sodium Uptake Along Primary Roots of Corn Seedlings,
Surge Waves, W73-03038	Persisting Circadian Oscillations in Enzyme Activity in Non-Dividing Cultures of Euglena,	W73-03085
17703030	W73-02969	Evidence for Hormonal Regulation of the Selectivity of Ion Uptake by Plant Cells,
Precoat Vacuum Filtration and Natural-Freeze	STIRLING UNIV. (SCOTLAND), DEPT. OF INDUSTRIAL SCIENCE.	W73-03113
Dewatering of Alum Sludge, W73-02965 5F	Effects of Water Stress on the Resistance to Uptake of Carbon Dioxide in Tobacco,	TEL-AVIV UNIV. (ISRAEL). LAB. FOR ELECTRON MICROSCOPY.
ENYDER (GEORGE E.) ASSOCIATES, INC.,	W73-03193	Effects of Streptomycin on the Ultrastructure of Plastids in Euglena,
ACKSON, MICH. (ASSIGNEE). Biochemical Sewage Treatment Via High Puri-	STOCKHOLM UNIV. (SWEDEN). Pollution: Taxation or Purification,	W73-02972
ty Molecular Oxygen,	W73-02911 5D	TELEDYNE BROWN ENGINEERING, HUNTSVILLE, ALA.
W73-03004 5D	SYRACUSE UNIV., N.Y.	Experimental Investigation of Effects of Un-
SOCIAL TECHNOLOGY SYSTEMS, INC., NEWTON, MASS.	Stresses and Movements in Oroville Dam, W73-02849 8D	steady Flows on a Submerged Cylinder, W73-03019
Troubled Waters, Lake Erie 1971, W73-02743 5B	TECHNICAL UNIV. OF BRNO	TELEDYNE ISOTOPES, LAS VEGAS, NEV. Distribution of Radioactivity in and Near the
SOIL CONSERVATION SERVICE, PORTLAND,	(CZECHOSLOVAKIA). Problems Concerning Solution of Steady and	Rainier Rubble Chimney,
DREG. ENGINEERING AND WATERSHED	Unsteady Groundwater Flow by Statistical Methods.	the state of the second state of the second state of the second s
PLANNING UNIT. Predicting sediment yield in Western United	W73-02826 2G	Long Term Release of Radioactivity from Rainier Melt-Glass,
States, W73-02795	TECHNICAL UNIV. OF ISTANBUL (TURKEY).	W73-02727
SOUTH CAROLINA UNIV., COLUMBIA, DEPT.	DIV. OF HYDRAULIC AND WATER POWER. Forces Due to Cylinders Falling Through Water	TENNESSEE UNIV., KNOXVILLE, WATER RESOURCES RESEARCH CENTER.
OF GEOLOGY. Pediments and Terraces along the Moapa Val-	in a Vertical Tube, W73-03021 8B	Experimental Investigation of Hydraulic Transients in River-Reservoir Systems, Phase
ley, Clark County, Nevada,	TECHNICAL UNIV. OF PRAGUE	III, W73-02706
W73-03146 2J	(CZECHOSLOVAKIA). SOIL SCIENCE LAB. Non-Darcian Flow of Water in Soils-Laminar	TENNESSEE VALLEY AUTHORITY, MUSCLE
SOUTH TAHOE PUBLIC UTILITY DISTRICT, SOUTH LAKE TAHOE, CALIF.	Region, W73-02836 2G	SHOALS, ALA. DIV. OF ENVIRONMENTAL RESEARCH AND DEVELOPMENT.
Capital and Operating Costs for Conventional and Advanced Waste Treatment.	TECHNION - ISRAEL INST. OF TECH., HAIFA.	Aquatic Radiological Monitoring Browns Ferry Nuclear Plant,
W73-02913 5D	Some Aspects of Heat and Mass Transfer in Porous Media,	W73-02736 5B
STANDARD OIL CO. OF INDIANA, CHICAGO,	W73-02823 2F	TENNESSEE VALLEY AUTHORITY, NORRIS.
ILL. Oil-Water Separating Process,	On the Flow of Two Immiscible Fluids in Frac-	ENGINEERING LAB. Hydrodynamic Forces on Diffuser Pipes Due
W73-02999 5G	tured Porous Media, W73-02828 2F	to Barge Passage,
STANDARD OIL CO. OF INDIANA, CHICAGO,	TECHNISCHE HOCHSCHULE, MUNICH	Taxatles and Pulluare-Some Comments.
ILL. (ASSIGNEE) Method and Apparatus for Removing Oil and	(WEST GERMANY). On the Optimization of the Design of Storage	TEXACO INC., NEW YORK. (ASSIGNEE) Eradicating Oil Slicks,
Debris from Water,	Areas at River Dams, W73-03239 4A	W73-02996 5G
W73-02997	THE MELENNICST SYMPETHON AUT	Method of Recovering Oil form an Oil Slick, W73-03007 SG
Process for Removing Contaminants from Waste-Water,	TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS). DEPT. OF CIVIL	Freezing Oil Spills,
W73-03003 5D.	ENGINEERING. Stationary Heat Transport by Plane Ground-	W73-03013 5G
STANFORD UNIV., CALIF. DEPT. OF CIVIL ENGINEERING.	water Movement in a Thin or a Thick Layer, W73-02820 2F	TEXAS A AND M UNIV., COLLEGE STATION. Contemporary Sources and Geochemistry of
Towards a Philosophy of Planning: An In-	The Tensor Character of the Dispersion Coeffi-	Tritium in the Gulf of Mexico and its Distribu- tive Province,
vestigation into Attitudes Held by Federal Water Resource Planners, W73-02955 6E	cient in Anisotropic Porous Media, W73-02831 2G	W73-02730 5B
An Approach for Involving Local Officials and	TECHNISCHE UNIVERSITAET, MUNICH	Optimized Geometry for Baffle Blocks in Hydraulic Jumps,
Citizens in Regional Water Quality Studies,	(WEST GERMANY). Amplitude-Dependent Frequency of An Oscil-	W73-03036 8B
W73-02956 SG	lating Cylinder in a High-Velocity Flow,	The Impact of Water Development on the
STATE UNIV. OF NEW YORK, ALBANY.	ROFF, KRINNARD AND LAPWORTH,	Ecology of River Systems, W73-03068
ATMOSPHERIC SCIENCES RESEARCH CENTER.	TECHNISCHE UNIVERSITAET, MUNICH (WEST GERMANY). BOTANISCHES INSTITUT.	The Impact of Water Development on Ecology
Handling Hot Water, With A Payoff, W73-02780 5G	Eco-Physiological Studies on Desert Plants. III. Respiration of Negatively Photoblastic	of the Gulf of Mexico, W73-03070 SB

TEXAS A AND M UNIV., COLLEGE STATION.	UNIVERSITY COLL., DUBLIN (IRELAND).	Effects of Detergent Polluted Water on So
DEPT. OF INDUSTRIAL ENGINEERING. Integrated Management of Quantity and Quali-	Age and Growth of Pike in Five Irish	Reaction and Plant Growth, W73-02620
ty of Urban Water Resources,	Limestone Lakes,	
Ŵ73-02666 5G	W73-02883 8I	The Effect of pH on Aerobic Sludge Digestion W73-02897
Systems Approaches to Microscale Problems	UNIVERSITY COLL. OF WALES,	VIRGINIA POLYTECHNIC INST. AND STATE
of Water Pollution Control, W73-03223 5G	ABERYSTWYTH. DEPT. OF GEOGRAPHY. Late-Stage Meander Growth,	UNIV., BLACKSBURG. DEPT. OF PLANT PATHOLOGY AND PHYSIOLOGY.
TEXAS A AND M UNIV., COLLEGE STATION.	W73-02796 2J	Improving Water Quality by Removal of Pest
DEPT. OF PLANT SCIENCES.	UNIVERSITY OF STRATHCLYDE, GLASGOW	cide Pollutants with Aquatic Plants,
The Influence of Low Substrate Sodium Levels	(SCOTLAND). DEPT. OF CIVIL	W73-02621 5
Upon the Free Amino Acid Content of Cotton	ENGINEERING.	VIRGINIA POLYTECHNIC INST. AND STATE
Leaves, W73-03089 3C	An Investigation into the Flow Behaviour Through Compacted Saturated Fine-Grained	UNIV., BLACKSBURG, VA. DEPT. OF CIVIL ENGINEERING.
An Effect of Water Stress on Ethylene Produc-	Soils with Regard to Fines Content and Over a Range of Applied Hydraulic Gradients,	Effect of Reservoir Drawdown on Optim
tion by Intact Cotton Petioles,	W73-02835 2G	Operation,
W73-03112 3F		W73-03244
TEXAS A AND M UNIV., COLLEGE STATION.	UNIVERSITY OF THE WITWATERSRAND,	VIRGINIA UNIV., CHARLOTTEVILLE, DEPT.
DEPT. OF WILDLIFE AND FISHERIES	JOHANNESBURG (SOUTH AFRICA), DEPT. OF	OF ENVIRONMENTAL SCIENCES.
SCIENCES.	GEOGRAPHY. Spatial Variation of Rainfall Spectra in South	The Determination of Primary Production in
Commercial Shrimp FarmingNearing Reali-	Africa,	Stream Using an Exact Solution to the Oxyge
ty,	W73-03100 2B	Balance Equation, W73-02971
W73-02932 3E		W/3-029/1
TEXAS A AND M UNIV., COLLEGE STATION.	UPPSALA UNIV., (SWEDEN).	VODOGRADBENI LABORATORIJ,
WATER RESOURCES INST.	Effects of Locomoter Restraint and of Anaesthesia with Urethane or MS-222 on the	LJUBLJANA (YUGOSLAVIA).
The Composition and Distribution of the Fish	Reactions of Young Salmon (Salmo salahrL.) to	The Adria (Monfalcone) - Danube Basin Inte
Fauna of the Navasota River,	Environmental Fluctuations of pH and Carbon	national Waterway, W73-03230
W73-02613 8I	Dioxide Tension,	
Water for Texas.	W73-03169 5C	VOLUNTEERS FOR INTERNATIONAL
W73-03066 5B	Acidim and Vantata Contact in the Bland of	TECHNICAL ASSISTANCE, INC.,
	Acidity and Lactate Content in the Blood of Young Atlantic Salmon (Salmo salar L.) Ex-	SCHENACTADY, N.Y. Village Technology Handbook.
THE DOW CHEMICAL CO., MIDLAND, MICH.	posed to High pCO2,	W73-02922
(ASSIGNEE)	W73-03170 5C	
Removal of Phosphate from Waste Water, W73-02990 5D		VSESOYUZNYI
W 13-02550 . 3D	UTAH STATE UNIV., LOGAN. DEPT. OF	NAUCHNO-ISSLEDOVATELSKII INSTITUT GIDROTEKHNIKI, LENINGRAD (USSR).
TOKYO UNIV. (JAPAN). DEPT. OF CIVIL	BOTANY. Mineral Ion Composition of Halophytic Species	Hydrodynamic Forces Due to Nonstationa
ENGINEERING; AND NORTH CAROLINA	from Northern Utah.	Oscillations of Cylindrical Shells in a Flu
UNIV., CHAPEL HILL. DEPT. OF CITY AND	W73-03117 2I	Medium with Deformations of the Cross-Se
REGIONAL PLANNING. An Alternative Approach for Finding Optimal		tion Taken into Account,
Control Rules of Reservoir Systems,	UTAH WATER RESEARCH LAB., LOGAN. Sorption in Flow Through Porous Media,	W73-03047
W73-03231 4A	W73-02839 2G	VSESOYUZNYI
	117-0207	NAUCHNO-ISSLEDOVATELSKII INSTITUT
TORONTO UNIV. (ONTARIO). DEPT. OF PHYSICS.	A Self-Verifying Hybrid Computer Model of	GIDROTEKNIKI, LENINGRAD (USSR).
Eddy Diffusion Coefficients due to Instabilities	River-Basin Hydrology,	Investigation of Nonstationary Hydrodynam Forces Induced by a Plate Oscillating in Liqu
in Internal Gravity Waves,	W73-03183 2A	Flow (Two-Dimensional Problem),
W73-02776 2E	VIRGINIA INST. OF MARINE SCIENCE,	W73-03050
	GLOUCESTER POINT.	RI HITCHIEF IT ILISEN
TOULOUSE UNIV. (FRANCE). INSTITUT DE MECANIQUE DES FLUIDS.	Autumn and Winter Occurrence of Decapod	VSESOYUZNYI NAUCHNO-ISSLEDOVATELSKII INSTITUT
Loss of Pressure Due to Periodic Movement of	Crustaceans in Chesapeake Bight, U.S.A., W73-02694 2L	VODOSNABZHENIYA, KANALIZATSII,
an Obstacle (Sur la perte de charge due a un	W/3-02094	GIDROTEKHNICHESKIKH SOORUZHENII
obstacle en mouvement periodique),	Thermal Effects of the Surry Nuclear Power	INZHENERNOI GIDROGEOLOGII, MOSCOW
W73-03020 8B	Plant on the James River, Virginia; Part II:	(USSR).
TRW SYSTEMS, REDONDO BEACH, CALIF.	Results of Monitoring Physical Parameters of	On Hydroelastic Correlations Between D ferent Forms of Oscillations of Plate in
Remote Sensing of Water Pollution,	the Environment Prior to Plant Operation, W73-02767 5C	Flow Boundary Resulting from Non-Uniform
W73-03132 5A	W 13-02101	Distribution of Averaged Flow Velocity
	VIRGINIA POLYTECHNIC INST. AND STATE	Depth,
TSENTRALNYI	UNIV., BLACKSBURG. DEPT. OF CIVIL	W73-03049
EKONOMIKO-MATEMATICHESKII INSTITUT, MOSCOW.	ENGINEERING.	VYSOKA SKOLA ZEMEDELSKA, BRNO
Optimum Use of Water Resources of Basins in	Optimal Conditioning Procedures for Waste Activated Sludge Disposal,	(CZECHOSLOVAKIA).
Irrigation,	W73-02616 5D	A Contribution to the Study of Transpiration
W73-03229 3F		Woody Species (In Czech.),
INSTER VINCEON ATOMIC PUPECY	Application of Biological Monitoring Systems	W73-02950
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, HARWELL (ENGLAND).	to Simulated Industrial Waste Discharge Situa-	WAKAYAMA FRUIT TREE EXPERIMENT
AUTHORITY HEALTH AND SAFETY BRANCH.	tions, W73-02617 5C	STATION (JAPAN).
Environmental Monitoring Associated with	7,17	Effects of Summer Application of Water a
Discharges of Radioactive Waste During 1969	Effects of Reservoir Operating Policy on	Nitrogen on Fruit Quality and Flowering
from UKAEA Establishments.	Recreation Benefits, W73-02618 6B	Satsuma Orange Trees (In Japanese), W73-02697
W73-03220 5B	W73-02618 6B	11 13-04071

ORGANIZATIONAL INDEX

TEXTS A AND MINING COLLEGE STATION.
WATER RESOURCE OF UNIT.
The Company of the human of the rest

WAPORA, INC., ROCKVILLE, MD. WATER QUALITY

WAPORA, INC., ROCKVILLE, MD. WATER QUALITY PROGRAMS. What Water and Waste Water Parameters	Antibodies Against Human Enteric Bacteria in Brown Bullheads (Ictalurus Nebulosus, Leseuer) from Contaminated Waters,
Should We Measure,	W73-02975 5C
W73-02976 5A	WESTINGHOUSE ELECTRIC CORP.,
WASHINGTON STATE DEPT. OF ECOLOGY, OLYMPIA. OFFICE OF TECHNICAL SERVICES.	PITTSBURGH, PA. (ASSIGNEE). Porous Support Tubes for Reverse Osmosis, W73-03009 3A
Petroleum Hydrocarbons and the Sea, W73-02866 5C	WORCESTER POLYTECHNIC INST.,
WASHINGTON STATE UNIV., PULLMAN.	HOLDEN, MASS. Hydrodynamic Forces on Single Intake Gates,
DEPT. OF ZOOLOGY. Ecological Techniques Utilizing Radionuclides	W73-03046 8B WYOMING UNIV., LARAMIE. DEPT. OF
and Ionizing Radiation. A Selected Bibliog- raphy,	GEOLOGY.
W73-02746 5B	Shallow Aquifers Relative to Surface Waters, North Platte River Valley, Goshen County,
WASHINGTON STATE WATER RESEARCH CENTER, PULLMAN.	Wyoming, W73-02900 4B
Columbia River Interstate Compact, Politics of	YALE UNIV., NEW HAVEN, CONN. SCHOOL
Negotiation, W73-02614 6E	OF MEDICINE.
Flood Hydrographs for Ungaged Streams, W73-02880 2E	An Epidemiological Study of the Effect of Fluorides in Drinking Water on the Frequency of Slipped Capital Femoral Epiphysis, W73-03071
WASHINGTON UNIV., SEATTLE.	that their replants to realization to 7. do
Synoptic Measurements of Currents and Sedi- ment Transport on the Continental Shelf. An- nual Progress Report,	ZAGREB UNIV. (YUGOSLAVIA). Critical Water Depth for Hydrodynamic In-
W73-02716 2L	duced Oscillation of Cantilevered Cylinders, W73-03055 8B
WASHINGTON UNIV., SEATTLE. COLL. OF FISHERIES.	ZAMBIA DEPT. OF AGRICULTURE, CHILANGA.
Low Level Chronic Irradiation of Salmon. An-	Available Water Capacities of Zambian Soils in
nual Progress Report, W73-02714 5C	Relation to Pressure Plate Measurements and Particle Size Analysis,
WASHINGTON UNIV., SEATTLE. DEPT. OF	W73-03065 2G
OCEANOGRAPHY. Columbia River Effects in the Northeast	
Pacific: Biological Studies. Progress Report, July 1971-June 1972. W73-02750 5B	
Columbia River Effects in the Northeast	
Pacific: Chemical and Geological Studies. Progress Report, Sept. 1971 to May 1972.	
W73-02751 5B	
Some Species of Phyllodocidae, Syllidae, Nephtyidae, Goniadidae, Apistobranchidae and Spionidae (Polychaeta) from the Northeast	
Pacific Ocean,	THE PART OF STREET
W73-03221 5B	
WASHINGTON UNIV., SEATTLE. SCHOOL OF MEDICINE.	
Organochlorine Insecticide, Herbicide and Polychlorinated Biphenyl (PCB) Inhibition of	
Nakatpase in Rainbow Trout, W73-03165 5C	
WATER RESEARCH INST., PRAGUE	Turning Hat Louis A Compress Light
(CZECHOSLOVAKIA). Hydraulic Downpull Increase at a Dam Gate	TO THE OWNER OF THE PERSON AND DRY
Caused by Hydrodynamic Forces, W73-03043 8B	TAX OF THE PROPERTY OF THE PRO
WEST VIRGINIA DEPT. OF NATURAL RESOURCES, CHARLESTON. DIV. OF WATER RESOURCES.	
Comprehensive Survey of Elk River Basin, Volume II, Economic Base Study,	
W73-02860 6D	
WEST VIRGINIA UNIV., MORGANTOWN.	
The Interaction of Sewage, Thermal, and Acid Mine Water Loadings on the Growth of	
Chlorella	

SC

W7 W7 W7 W7

W7 W7 W7 W7 W7

W73-026

W73-026 W73-02 W73-02 W73-02 W73-02 W73-02

W73-02 W73-02 W73-02 W73-02 W73-02 W73-02 W73-02

W73-02 W73-02

W73-0

W73-0 W73-0

W73-0 W73-0

W73-0 W73-0

W73-0

W73-0

W73-02974

ACCESSION NUMBER INDEX

W73-02601	5D	W73-02679	3F	W73-02757	8B	W73-02835	2G
W73-02602	5B	W73-02680	3C				
				W73-02758	4A	W73-02836	2G
W73-02603	5D	W73-02681	8I	W73-02759	5G	W73-02837	2G
W73-02604	21	W73-02682	81	W73-02760	5C	W73-02838	2F
W73-02605	8B	W73-02683	81	W73-02761	8B	W73-02839	2G
W73-02606	5B	W73-02684	5C	W73-02762	5C	W73-02840	6B
W73-02607	5D	W73-02685	8I	W73-02763	5G	W73-02841	8A
W73-02608	5F	W / 1-U2686	21	W73-02764	5G	W73-02842	8C
W73-02609	5A	W73-02687	21	W73-02765	5G	W73-02843	8C
W73-02610	6D	W73-02688	21	W73-02766	5C	W73-02844	5A
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W73-02648	2C	W73-02726	5B	W73-02804	3D	W73-02882	21
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		W73-02746	5B	W73-02824	2F	W73-02902	5G
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W73-02673	3F	W73-02751	5B	W73-02829	2G	W73-02907	5G
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W73-02924	3E			W73-03003	5D		W73-03082	2D		W73-03161	5C
W73-02925	2D			W73-03004	5D		W73_03083	8I		W73-03162	5C
W73-02926	3E			W73-03005	3A			3C	WYNOLOGY IF		5C
W73-02927	81			W73-03006	2G		W73_03085	3C			5C
W73-02928	5B			W73-03007	5G		W73-03086	21			5C
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W73-02932	3E			W73-03011	5G		W73-03090	3F		W73-03169	5C
W73-02933	6B			W73-03012	3A		W73-03091	4A			5C
W73-02934	5G			W73-03013	5G		W73-03092	6E			5C
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W73-02959	5G			W73-03038	8B		W73_03117	21		W73-03196	5B
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W73-02967	5C			W73-03046	8B		W73-03125	6B		W73-03204	5G
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W73-02969	-5C			W73-03048	8B		W/73_03127	5F	BE SELEPTEN	W73-03206	2D
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W73-02971	5C			W73-03050	8B	NAS-USBEZ UB	W73-03129	5F	RS DETERMENT	W /3-03208	
W73-02972	5C			W73-03051	8B		W73-03130	3F	AZ BETSBETTS	W /3-03209	2G
W73-02973	5A			W73-03052	8B		W73-03131	5A		W /3-03210	2G
W73-02974	5C			W73-03053	8B	SIL STREET	W /3-03132	5A		W/3-03211	2G
W73-02975	5C			W73-03054	8B	PT VINE TE	W/72_02122	7B	HE INTEGRAL		2G
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W73-02977	5B			W73-03056	8B			7B	THE CHILDREN		2G
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W73-02981	5D			W73-03060	8B		W73-03139	4B		W/3-03218	6E
W73-02982	5D			W73-03061	8B		W73-03140	5A	WY BATTER CTV	W/3-03219	6E
W73-02983	5D			W73-03062	8B			2J			5B
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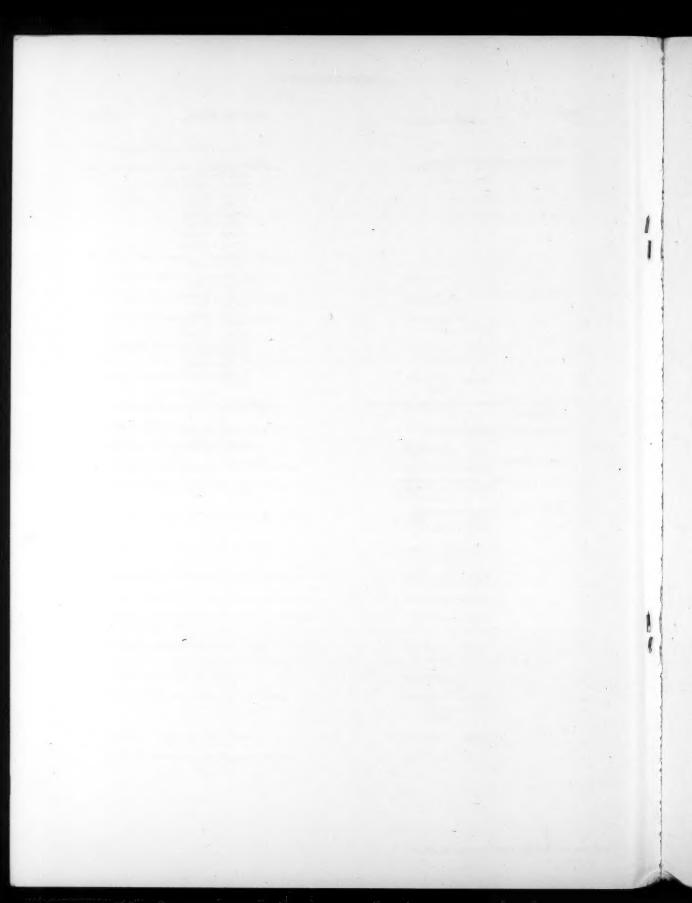
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Sou	urce	Accession Number	Total
A.	Centers of Competence		
	AEC Oak Ridge National Laboratory, Nuclear Radiation and Safety	W73-02708 — 02710 02712 — 02717 02719 — 02727 02729 — 02748 02750 — 02755	44
	American Water Works Association Research Foundation, Public Water Supply Treatment Technology	W73-03173 03178 03182	7
	American Water Works Association Research Foundation, Water Treatment Plant Waste Pollution Control	W73-02964 - 02965	2
	Battelle Memorial Institute, Methods for Chemical and Biological Identification of Pollutants	W73-03220 03224	2
	Bureau of Reclamation, Engineering Works	W73-02840 02852 02854 03247 04250	18
	Cornell University, Policy Models for Water Resources Systems	W73-02664 — 02667 02707, 02853 02943 — 02944 02946 03222 — 03245	33
	University of Arizona, Arid Land Water Resources	W73-03072 - 03082 03084 - 03090 03092 - 03095 03097 - 30101 03103 - 03107 03110 03112 - 03114 03116 - 03130	51
	University of Florida, Eastern U. S. Water Law	W73-03017 03216 03219	5
	University of Texas, Wastewater Treatment and Management	W73-02958 - 02963	6
	University of Washington, Water Quality Requirements for Aquatic Organisms	W73-03156 03158 03160 03171	15
	University of Wisconsin, Water Resources Economics	W73-02901 — 02924 02926, 02929 02931 — 02938 02941 — 02942	36
	University of Wisconsin, Eutrophication	W73-02966 - 02980 03016, 03184	17
	U. S. Geological Survey, Hydrology	W73-02630 02643 02645 02663 02706 02781 02839 02877 02879 03018 03070 03131 03155 03183	175
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ABSTRACT SOURCES

A. Centers of Competence (cont'd)	Compatence	A. Cimuis of
Vanderbilt University, Thermal Pollution	W73-02757 02759 02780	23
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B. State Water Resources Research Institutes		
California Water Resources Center	W73-02601	1
Colorado Environmental Resources Center	W73-02873	ora sina 1
Connecticut Institute of Water Resources	W73-02885 03185 03186	lowerd 3
Delaware Water Resources Center	W73-02619, 02622 02874 - 02875	Muraid 4
Illinois Water Resources Center	W73-02602 - 02605 02887	5
Indiana Water Resources Research Center	W73-03191	dienound 1
Kansas Water Resources Research Institute	W73-03187 - 03188	2
Michigan Institute of Water Research	W73-02606	1
Minnesota Water Resources Research Center	W73-02888, 03189	2
Missouri Water Resources Research Center	W73-02607 02608 02615	Villavovinu) 3
New Mexico Water Resources Research Institute	W73-02623, 02876 02889 02891	ytigasvinti manraM
North Carolina Water Resources Research Institute	W72-02629 - 02629	yramelet 3
Oklahoma Water Resources Research Institute	W73-02609, 02892	2
Oregon Water Resources Research Institute	W73-02893 - 02894	2
Pennsylvania Institute for Research on Land and Water Resources	W73-02610 - 02612	villamental.
Rhode Island Water Resources Center	W73-02624 - 02627 02895	5 This Sand
Texas Water Resources Institute	W73-02613	1
Virginia Water Resources Research Center	W73-02616 02618 02620 02621 02897	6
Washington Water Research Center	W73-02614, 02880	2
Wyoming Water Resources Research Institute	W73-02900	1

ABSTRACT SOURCES

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. Other		
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Environmental Protection Agency	W73-02947 - 02949 02951 - 02956	9
Forest Service	W73-02957	1
Ocean Engineering Information Service	W73-02981 - 03005 03007 - 03015	34
Office of Water Resources Research	W73-02871 - 02872	2



CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- ▶ Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- ▶ Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- ▶ Water resources economics at the Water Resources Center of the University of Wisconsin.
- ▶ Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- ▶ Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- ▶ Water well construction technology at the National Water Well Association.
- ▶ Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- ▶Public water supply treatment technology at the American Water Works Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC

- ▶ Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- ► Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- ▶ Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- ▶ Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- ▶ Water treatment plant waste pollution control at American Water Works Association.
- ► Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.

Subject Fields

- NATURE OF WATER
- WATER CYCLE
- WATER SUPPLY AUGMENTATION AND CONSERVATION
- WATER QUANTITY MANAGEMENT AND CONTROL
- WATER QUALITY MANAGEMENT AND PROTECTION
- WATER RESOURCES PLANNING
- RESOURCES DATA
- **ENGINEERING WORKS**
- MANPOWER, GRANTS, AND **FACILITIES**
- SCIENTIFIC AND TECHNICAL 10 INFORMATION

INDEXES

- SUBJECT INDEX
- **AUTHOR INDEX**
 - ORGANIZATIONAL INDEX
 - ACCESSION NUMBER INDEX
- **ABSTRACT SOURCES**



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